RF-OSH60200-B14-0002

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incorporated comments 10/27 Except for Appendix A-MV

# DRAFT
# TECHNICAL MEMORANDUM NO. 1

# WORK PLAN ADDENDUM
# PHASE I RFI/RI

## FIELD SAMPLING PLAN
## ORIGINAL PROCESS WASTE LINES
## VOLUME I - TANKS

### Part A - Outside Tanks

### Rocky Flats Plant

### (Operable Unit No. 9)

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Prepared for:

U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

September 1993







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## APPENDICES

# LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| $CCl_4$ | Carbon Tetrachloride |
| CDH | State of Colorado Department of Health |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| D&D | Decontamination and Decommissioning |
| DOE | U.S. Department of Energy |
| EMD | Environmental Management Department |
| EPA | U.S. Environmental Protection Agency |
| HPGe | High Purity Germanium |
| HRR | Historical Release Report |
| IA | Industrial Area |
| IHSS | Individual Hazardous Substance Site |
| NaI | Sodium Iodide |
| OP | Operating Procedure |
| OPWL | Original Process Waste Lines |
| OU | Operable Unit |
| PCBs | Polychlorinated Biphenyls |
| RCRA | Resource Conservation and Recovery Act |
| RF | Rocky Flats |
| RFI/RI | RCRA Facility Investigation/Remedial Investigation |
| RFP | Rocky Flats Plant |

## LIST OF ABBREVIATIONS AND ACRONYMS

**(continued)**

| | |
|---|---|
| TAL | Target Analyte List |
| TCL | Target Compound List |
| TOC | Total Organic Carbon |

# DRAFT TECHNICAL MEMORANDUM NO. 1
# FIELD SAMPLING PLAN
# ORIGINAL PROCESS WASTE LINES VOLUME 1- TANKS
# PART A-OUTSIDE TANKS

## 1.0 INTRODUCTION

This document is submitted in partial fulfillment of Technical Memorandum No. 1 requirements and presents the first part (Volume I, Part A) of the Field Sampling Plan for Operable Unit (OU) 9. Volume I, Part A presents the Field Sampling Plan for tanks located in areas outside of the large buildings; Volume I, Part B of Technical Memorandum No. 1 will present the Field Sampling Plan for tanks located inside large buildings; and Volume II of Technical Memorandum No. 1 will present the sampling plan for pipelines. Part B of Volume I and Volume II will be submitted at a later date as an addendum to Technical Memorandum No. 1.

This work is conducted under the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation (RFI/RI) for OU9. Sampling is part of a comprehensive, multi-staged program of site characterization, RIs, feasibility studies, and remedial/corrective actions currently in progress at the U.S. Department of Energy (DOE) Rocky Flats Plant (RFP). These activities are pursuant to an Inter-Agency Agreement (IAG) among DOE, the U.S. Environmental Protection Agency (EPA), and the State of Colorado Department of Health (CDH), dated January 22, 1991 (DOE, 1991). The IAG program developed by DOE, EPA, and CDH, addresses RCRA and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) issues, although RCRA regulations take precedence for investigations at OU9 (DOE, 1992a). Further information on the investigation at OU9 is found in the *Phase I RFI/RI Work Plan OU9* (DOE, 1992a).

## 1.1 BACKGROUND

OU9 is the Original Process Waste Lines (OPWL). The OPWL comprises 39 tank locations (included are an assortment of above-, on-, and below-grade tanks; floor sumps; valve vaults; secondary containment structures; and process waste pits) and approximately 35,000 feet of pipeline. In addition, there are nine IHSSs that have been identified for many of the same tank locations. Tank and overlapping IHSS numbers are listed and described in Table 1-1. Tank locations are shown in Figure 1-1.

The general function of the OPWL was to transfer and store process waste from facilities that generated the wastes to the process waste treatment facility that was housed in Building 774. The OPWL transported (or stored in OPWL tanks) various aqueous process wastes containing low-level radioactive materials, nitrates, caustics, and acids. Small quantities of other liquids were also handled in the system, including pickling liquor from foundry operations, medical decontamination fluids, miscellaneous laboratory wastes, and laundry effluent. Certain process waste streams also contained metals, volatile organic compounds, oil and grease, and cleaning compounds (DOE, 1992a).

## 1.2 PURPOSE AND SCOPE

Sampling activities for OU9 will be addressed in two separate parts: Volume I - Tanks, and Volume II - Pipelines. Volume I, the tank investigations, will be addressed first because they pose a greater risk from a potentially larger volume of contaminants. Volume I has been divided into two areas: Part A addresses tanks located outside of the buildings, and Part B will address tanks located inside of the buildings. The subject of this Technical Memorandum is Volume I, Part A - Outside Tanks. Part B (Inside Tanks) and Volume II (Pipelines) is anticipated to be submitted at a later date.

The outside tanks in the OPWL are generally tanks in open areas of the Industrial Area (IA) at RFP and are either outside or are within small buildings that only enclose the tank. There are 19 outside tank locations. The tank numbers and descriptions are listed in Table 1-2.

121
127
123.20
147.10

# TABLE 1-1
# TANK DESCRIPTIONS
# OU9 ORIGINAL PROCESS WASTE LINES

| TANK NUMBER | IHSS | BUILDING NO.(1) | NUMBER OF TANKS | CONSTRUCTION TYPE(2) | VOLUME (gal) | CONSTRUCTION MATERIAL(3) | TANK STATUS(4) | YEAR INSTALLED |
|---|---|---|---|---|---|---|---|---|
| T-1 | NA | 122 | 1 | UG | 800 | SS | Removed (Jan 1984) | 1955 |
| T-2 | 122 | 441 | 1 | UG | 3,000 | Conc | Abandoned (June 1982) | 1952 |
| T-3 | 122 | 441 (429) | 2 | 1 - UG, 1 - AG1 | UG-3,000, AG-3,200 | UG-Conc, AG-Stl | Abandoned (June 1982) | 1952 |
| T-4 | NA | 447 | 3 | FS | 60 ea | Conc | Active(a) | 1962 |
| T-5 | NA | 444 | 2 | AG1 | 4,000 ea | Stl | Active(b) | 1952 |
| T-6 | NA | 444 | 2 | FS | 500 & 300 | Conc | Active(a) | 1952 |
| T-7 | 159 | 559 (528) | 2 | AG2 | 2,000 ea | Stl | Activ(c) | 1969 |
| T-8 | 126 | 771 (728) | 2 | UG | 25,000 ea | Conc | Plenum deluge(d) | 1952 |
| T-9 | 132 | 776 (730) | 2 | UG | 22,500 ea | Conc | Plenum deluge(d) | 1955 |
| T-10 | 132 | 776 (730) | 2 | UG | 4,500 ea | Conc | Abandoned (Dec 1982) | 1955 |
| T-11 | NA | 707 (731) | 2 | UG | 2,000 ea | Conc | Activ(e) | 1959 |
| T-12 | NA | N/A | N/A | N/A | N/A | N/A | Invalid tank location | N/A |
| T-13 | 215 | 774 | 1 | SU | 600 | Conc | Abandoned (1972) | 1952 |
| T-14 | 124 | 774 | 1 | UG | 30,000 | Conc | Active | 1952 |
| T-15 | 146 | 774 | 2 | UG | 7,500 ea | Conc | Removed (1972) | 1969 |
| T-16 | 124,125 | 774 | 2 | UG | 14,000 ea | Conc | Active | 1952 |
| T-17 | 146 | 774 | 4 | UG | 2-3,750; 2-7,500 | Conc | Removed (1972) | 1969 |
| T-18 | NA | 778 | 1 | SU | Unknown | Conc | Abandoned (1982?) | Unk. |
| T-19 | NA | 779 | 2 | SU | 1,000 ea | Conc | Plenum deluge(d) | 1964 |
| T-20 | NA | 779 | 2 | SU | 8,000 ea | Conc | Abandoned (Dec 1982) | 1964 |
| T-21 | NA | 886 (828) | 1 | FS | 250 | Conc | Abandoned (1978) | 1963 |
| T-22 | NA | 886 (828) | 2 | AG2 | 250 ea | SS | Abandoned (1978) | 1963 |
| T-23 | NA | 865 | 1 | SU | 6,000 | Conc | Abandoned (May 1982) | 1979 |
| T-24 | NA | 881 (887) | 7 | AG2 | 2,700 ea | Stl | Active(b) | 1952 |
| T-25 | NA | 883 | 2 | AG1 | 750 ea | Stl | Active(b) | 1952 |
| T-26 | NA | 883 | 3 | AG1 | 750 ea | Stl | Active(b) | 1965 |
| T-27 | NA | 881 | 1 | AG1 | 500 | Stl | Removed (July 1989) | Unk. |
| T-28 | NA | 889 | 2 | FS | 1,000 | Conc | Active(a) | 1965 |



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28 28

# TABLE 1-1
# TANK DESCRIPTIONS
# OU9 ORIGINAL PROCESS WASTE LINES

| TANK NUMBER | IHSS | BUILDING NO.(1) | NUMBER OF TANKS | CONSTRUCTION TYPE(2) | VOLUME (gal) | CONSTRUCTION MATERIAL(3) | TANK STATUS(4) | YEAR INSTALLED |
|---|---|---|---|---|---|---|---|---|
| T-29 | NA | 774 | 1 | OG | 200,000 | Stl | Abandoned (1985) | 1952 |
| T-30 | NA | 707 (731) | 1 | SU | 23,111 | Conc | Active(e) | 1959 |
| T-31 | NA | N/A | N/A | N/A | N/A | N/A | Invalid tank location | N/A |
| T-32 | NA | 881 (887) | 1 | SU | 131,160 | Conc | Active(e) | 1952 |
| T-33 | NA | N/A | N/A | N/A | N/A | N/A | Invalid tank location | N/A |
| T-34 | NA | N/A | N/A | N/A | N/A | N/A | Invalid tank location | N/A |
| T-35 | NA | N/A | N/A | N/A | N/A | N/A | Invalid tank location | N/A |
| T-36 | NA | 771C | 1 | SU | 500 | Stl | Abandoned (1984) | 1965 |
| T-37 | NA | 771C | 1 | SU | 500 | Conc | Abandoned (1984?) | Unk. |
| T-38 | NA | 779 | 1 | AG2 | 1,000 | Stl | Active(c) | Unk. |
| T-39 | NA | 881 | 4 | AG1 | 250 ea | Stl | Removed (1975) | 1952 |

Notes:

(1) Building numbers in parentheses are process waste pits adjacent to production buildings.

(2) Tank Types:

| | |
|---|---|
| FS | Floor Sump (used for spill control) |
| SU | Sump (open-top or covered) |
| UG | Underground (sealed, permanently closed top) |
| AG1 | Above-Grade |
| AG2 | Above-Grade in sump |
| OG | On-Grade |

(3) Tank Materials:

| | |
|---|---|
| SS | Stainless Steel |
| Stl | Steel |
| Conc | Concrete |

(4) Active Tank Categories (as marked):

| | |
|---|---|
| a | Incidental spill control; not RCRA-permitted |
| b | RCRA-permitted process waste tank |
| c | 90-day transuranic waste tank |
| d | Converted to the RFP plenum fire deluge system as a firewater catch tank |
| e | Secondary containment for RCRA-permitted waste tank |

N/A = Not Applicable
NO = Number
RCRA = Resource Conservation and Recovery Act
RFP = Rocky Flats Plant

TABLE 1-2
OUTSIDE TANK/INDIVIDUAL HAZARDOUS SUBSTANCE SITE NUMBERS AND DESCRIPTIONS
OU9 ORIGINAL PROCESS WASTE LINES

| TANK NUMBER | OTHER IHSS NOS | EG&G TANK NUMBER | BUILDING NO. | NUMBER OF TANKS | CONSTRUCTION TYPE | VOLUME | CONSTRUCTION MATERIAL | WASTE STREAM | TANK STATUS | DATE | AIR EMISSION INVENTORY NO. | RCRA ID NUMBER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T-1 | NA | UNKNOWN | 122 | 1 | UG | 600 | STAINLESS | BLDG 122 WASTE | REMOVED | JAN 1984 | - | - |
| T-2 | 122 | UNKNOWN | 441 | 1 | UG | 3,000 | CONCRETE | BLDG 122, 123, 441 WASTE | PART REMOVED | 1986 | - | - |
| T-3 | 122 | T-123 | 441 | 1 | AG | 3,200 | STEEL | BLDG 122, 123, 441 WASTE | ABANDONED | JUNE 1982 | #00076 | - |
| | | | | 1 | UG | 3,000 | CONCRETE | BLDG 122, 123, 441 WASTE | ABANDONED | JUNE 1982 | #00077 | - |
| T-7 | 159 | T1-522, T2-523 | 559(526) | 2 | AG in sump | 2,000 | STEEL | BLDG 559 WASTE | ACTIVE, 90 DAY | | - | ? |
| T-8 | 126 | T8 EAST, T8 WEST | 771(726) | 2 | UG | 25,000 | CONCRETE | 771 WASTE AND 771 PLENUM DELUGE | CONVERTED TO PLENUM DELUGE | MAY 1984 | T1-#00292, T2-#00293 | - - |
| T-9 | 132 | 730 TANKS | 776(730) | 2 | UG | 22,500 | CONCRETE | LAUNDRY WATER FROM BLDG 776 | CONVERTED TO PLENUM DELUGE | OCT 1984 | | - |
| T-10 | 132 | 730 TANKS | 776(730) | 2 | UG | 4,500 | CONCRETE | LAUNDRY WATER FROM BLDG 776 | ABANDONED | DEC 1982 | | - |
| T-11 | NA | EAST & WEST PROCESS WASTE TANKS | 707(731) | 2 | UG | 2,000 | CONCRETE | BLDG 707 | ACTIVE, INCIDENTAL SPILL CONTROL | | - | CONTAMINANT REF #2011 |
| T-30 | NA | 731 STRUCTURE | 731 | 1 | SUMP | 23,111 | CONCRETE | BLDG 707 | ACTIVE, INCIDENTAL SPILL CONTROL | | - | CONTAMINANT REF #2011 |
| T-14 | 124 | T-66 | 774 | 1 | UG | 30,000 | CONCRETE | BLDG 774 HIGH-NITRATE WASTE | ACTIVE / RCRA? | | #184, NDT-1167 | #55.16 |
| T-16 | 124, 125 | T-66, T-67 | 774 | 2 | UG | 14,000 | CONCRETE | BLDG 774 HIGH-NITRATE WASTE | ACTIVE / RCRA? | | NDT-T66-1165, NDT-T67-1166 | T66-#55.14, T67-#55.15 |
| T-15 | 146 | T-34E, T34W | 774 | 2 | UG | 7,500 | CONCRETE | BLDG 774 TREATED AQUEOUS WASTE | REMOVED | 1972 | - | - |
| T-17 | 146 | T-30, T-33 | 774 | 2 | UG | 3,750 | CONCRETE | BLDG 774 TREATED AQUEOUS WASTE | REMOVED | 1972 | - | - |
| | | T-31, T-32 | | 2 | UG | 7,500 | CONCRETE | BLDG 774 TREATED AQUEOUS WASTE | REMOVED | 1972 | - | - |
| T-21 | 164.2 | BLDG 881 FLOOR SUMP | 886(826) | 1 | FS | 250 | CONCRETE | INCIDENTAL OVERFLOW FROM T-22 | ABANDONED | 1978 | ? | - |
| T-22 | 164.2 | TANKS 440, 449 | 886(826) | 2 | AG | 250 | STAINLESS | T440-BLDG 886 Room 101 & 103 WASTE T449-FISSILE URANIUM WASTE | ABANDONED | 1978 | #00039, #000294 | - - |
| T-27 | | PORTABLE LIQUID DUMPSTER | 886 | 1 | AG | 500 | STEEL | FROM T-22, BLDG 886 | REMOVED | JULY 1989 | - | - |
| T-24 | | T-183, 184, 185, 802A, 802B, 802C, 802D | 881(887) | 7 | AG | 2,700 | STEEL | BLDG 881 WASTE | ACTIVE/RCRA | | - | #40.20-40.26 |
| T-32 | | BLDG 881 PROCESS WASTE PIT | 881(887) | 1 | SUMP | 131,160 | CONCRETE | BLDG 881 WASTE | ACTIVE/RCRA | | - | SCR #2014 |
| T-29 | 137 | T-207 | SOUTH 774 | 1 | ON-GRADE | 200,000 | STEEL | UNTREATED 774 WASTE | ABANDONED | 1965 | #00196, NDT-1184 | #40 |

NOTES:

AG = aboveground
Bldg. = Building
gal = gallons
ID = Identification
NOS = Numbers
RCRA = Resources Conservation and Recovery Act
UG = underground
FS = Floor Sump

The tank investigations comprise two stages. Stage 1 is designed to locate areas of contamination within the OU9 vadose zone soils and to assess the nature of contamination at these locations. Technical Memorandum No. 1 is for Stage 1 sampling activities that consist of the following:

- visual inspections of tanks;
- residue and wipe samples;
- surface soil samples;
- soil boreholes and soil samples;
- water samples from valve vaults;
- groundwater samples from soil boreholes; and
- radiological measurements.

As part of Stage 1 activities, soil and groundwater samples will be collected from boreholes located as closely as possible to the tanks to verify if leaks have occurred. Residue or wipe samples will be collected from inactive tanks that have not been decontaminated (i.e., cleaned and painted). These samples will be used to evaluate the tanks' historical contents and will help determine potential closure activities such as removal, decontamination, filling with inert material and capping, or future decontamination and decommissioning (D&D). The rationale for placement of sample locations is described in Section 3.1, Rationale.

The Stage 2 investigation will determine the horizontal and vertical extent of contamination in vadose zone soils around OPWL tank locations identified as contaminated during Stage 1 activities. Stage 2 sampling activities will be based on Stage 1 sampling results and will be addressed in a future technical memorandum that will describe the recommended additional sampling in detail.

Depending on the Stage 1 sample results, Stage 2 investigations may consist of the following types of sampling activities:

- soil boreholes and soil samples;
- groundwater monitoring well installation;
- soil-gas surveys; and
- surface soil sampling.

## 2.0 PRELIMINARY FIELD ACTIVITIES

Preliminary field activities for the Stage 1 investigation include a limited data compilation, site walks, and utility clearances. Of these, the data compilation and site walks have been completed. The utility clearances are proposed to be completed before any sampling is performed. Each activity is discussed below.

### 2.1 DATA COMPILATION

Data compilation consisted of reviewing available information on OU9 OPWL. The data compilation task included a review of available engineering drawings, photo logbooks of Tank T-7 and the concrete pad at Tank T-27, the Historical Release Report (HRR) (DOE, 1992b), the RCRA Post-Closure Care Permit Application (DOE, 1988), OU9 Work Plan, and limited interviews with personnel involved with RFP process operations who were available at the time of site walks.

Since data for most tanks are complete, no other records for tanks were reviewed to supplement this Technical Memorandum. The records review will be used primarily to gather additional information for OPWL pipelines. If additional pertinent information on tanks is obtained during records review for pipelines, the new information will be incorporated into the tank investigation during Stage 2 activities.

## 2.2 SITE WALKS

Site walks for the outside tanks were conducted between July 29,1993 and August 13, 1993. The site walks identified:

- locations of structural features such as overhead or underground piping, visual utilities, valves vaults, manways to tanks, etc.;
- areas where construction activities may have disturbed OPWL components or IHSS specific features; and
- logistical problems associated with field sampling activities such as security requirements, heavy equipment access restrictions, interference with RFP operations, health and safety concerns, or other difficulties in accessing areas for sampling.

A site walk with DOE, EG&G, CDH, EPA, and Jacobs Engineering Group Inc.'s (Jacobs) personnel was conducted on August 20, 1993 to review proposed sample locations.

## 2.3 UTILITY CLEARANCE

Utility clearances will be performed by ~~EG&G~~ Rocky Flats plant construction personnel; ~~Jacobs~~ will be obtain~~clearance from EG&G~~ Clearance for all boreholes prior to drilling. Existing information on OPWL locations and the utility maps indicates that a complex matrix of utilities surrounds the OPWL. Placement of selected borehole locations may be difficult at times due to existing utilities. Because of this, borehole locations may need to be off-set from the original location. Information on the off-set location and reasons for off-setting will be written into the OU9 Field Log Book.

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## 3.0 SAMPLING - OUTSIDE TANKS

The historical use of each tank and the available data were used to develop sampling strategies. Historical information presented in the HRR (DOE, 1992b) and the OU9 Work Plan provides general indications of the types of compounds that may be anticipated at each tank location. Soil contamination may have resulted from historical spills, tank and pipeline leaks or improper storage of hazardous materials. Asphalt paving, concrete, or soil regrading occurred after many of the historically reported incidents, removing visible evidence of spills or possible releases.

How about excavation or clean up?

### 3.1 SAMPLING RATIONALE

The sampling rationale that has been developed will provide an approach to accomplishing the objectives of the IAG and the OU9 Work Plan. (See Appendix A for IAG and OU9 Work Plan requirements.) Phase I sampling activities at OU9 will be conducted in two stages. Stage 1 sampling activities are designed to detect points of contamination in OU9 vadose zone soils. Stage 2 activities will determine horizontal and vertical extent of contamination in vadose zone soils identified as contaminated during Stage 1. Limited information acquired from RFP Process personnel and physical constraints identified during site walks were considered when determining the proposed sample locations for Stage 1 activities.

OU9 OPWL components include above-grade, on-grade, and below-grade tanks. In general, the multi-task survey and sampling approach described below will be used to determine the potential source locations for each tank.

#### 3.1.1 Radiation Surveys

Radiation surveys will be conducted to assess radioactive contamination. Radiological survey techniques for surface soils will include high purity germanium (HPGe) surveys

supplemented with sodium iodide (NaI) surveys. The areas to be surveyed and the configuration of the survey pattern will be developed on a case-by-case basis using all available historical information on the particular area. The HPGE survey will be conducted first because it provides greater areal coverage and higher quality results. The HPGe gamma ray detector that will be used is capable of high resolution gamma ray spectroscopy enabling the identification and quantification of gamma-emitting radionuclides. The HPGe survey will be performed by EG&G technical personnel with limited assistance from Jacobs. The NaI survey will consist of performing a 10-foot-grid survey with NaI detector to delineate specific radioactivity anomalies detected by the HPGe survey. The number of locations included in the NaI surveys will be based on the HPGe results.

A prework health and safety radiation survey of borehole locations will also be conducted to assess radioactive contamination. Surveys will be conducted using the NaI instrument.

Health and safety radiation surveys will be conducted in accordance with Environmental Management Department (EMD) Operating Procedure (OP) FO.16, Field Radiological Measurements.

### 3.1.2 Residue or Wipe Sampling

To help characterize OPWL wastes, residue samples will be collected from each abandoned tank that has not been cleaned since its removal from process waste service. In instances where no residue is present, one wipe sample will be taken from the interior surface of the tank (preferably at the base of the tank or near pipeline connections). This will provide a qualitative measure of radionuclide contamination. Where possible, residue or wipe samples will be collected remotely to mitigate the need for entry into confined spaces.

### 3.1.3 Incidental Water Sampling

Sampling of incidental (surface water or groundwater) will be conducted to characterize potential contamination of valve vaults.

### 3.1.4 Surface Soil Sampling

Surface soil samples will be collected at suspected contamination release locations, such as potential locations of surface spills or leaks, to assess the nature of contamination. Two types of surface soil samples will be collected: surface soil composite using the Rocky Flats (RF) method and surface soil grab. The surface soil composite sample is used to determine if contamination is present at a particular location. The surface soil grab sample is collected at a specific location where visible and known releases may have occurred, to the determine nature of contamination.

### 3.1.5 Soil Boreholes

Boreholes will be drilled and sampled to identify areas of contamination adjacent to a tank location. As discussed in the OU9 Work Plan, contamination will most likely exist at the following locations around OPWL tanks:

- beneath or near external connections and openings;
- near joints or corners around underground tanks; and
- beneath the base of the tank.

Areas beneath or near external connections and openings, and near joints or corners around underground tanks, will be targeted as primary borehole locations. As a general rule, boreholes will be drilled on each accessible side of the tank or vault, as closely as possible to the tank or vault. For locations where the tanks were removed, a single borehole will be drilled as closely as possible to the center of the original tank location. Where multiple

tanks existed at a single location, boreholes will be drilled at the original center of each individual tank location. In general, three soil samples will be collected from each borehole (EG&G, 1992). For below-grade tanks, the samples will be collected at the following locations:

- ground surface (before drilling);
- 1 to 3 feet below the base of the tank, unless the tank is in bedrock (if the base of the tank extends into bedrock, this sample will not be collected); and
- directly above the water table or bedrock/alluvium contact, whichever is encountered first.

For above-grade or on-grade tanks, samples will be collected at the following locations:

- ground surface (before drilling);
- mid-depth between the ground surface and the water table or bedrock/alluvium interface, whichever is encountered first (if the depth between the ground surface and the water table or bedrock is less than 5 feet at above-grade tank locations, the mid-depth soil sample will be omitted); and
- directly above the water table or bedrock/alluvium contact, whichever is encountered first.

In areas where previous analytical results have indicated the presence of contamination, sample intervals will be at:

- ground surface (before drilling); and

- composite samples at each 2-foot interval to a depth of 10 feet below the base of the tank, or until the water table or bedrock is encountered.

### 3.1.6 Groundwater Sampling

Groundwater sampling, using a BAT® sampler or equivalent in soil boreholes drilled into the saturated zone, will be conducted to characterize potential contamination of the groundwater.

## 3.2 SAMPLE LOCATIONS AND FREQUENCY

This section describes the specific field investigations proposed for each tank/IHSS including sample locations and intervals. Table 3-1 shows the number and type of samples for each tank. The exact number of samples collected may change based on field conditions such as the location of utilities in the area, depth to bedrock, depth to the water table, and presence of groundwater. The number of NaI surveys required will depend on the results of the HPGe surveys, and those exact numbers cannot be determined at this time.

Stage 1 sampling activities are based on present tank conditions (assessed during site walks) and historical use, and are designed to define the nature of contamination at the tank.

TABLE 3-1
SAMPLE TYPE, MEDIA, AND ANALYTES
OU9 ORIGINAL PROCESS WASTE LINES

| TANK No. | OTHER IHSS No. | TANK INSPECTION | HPGe/NaI SURVEY | RESIDUE OR WIPE (1) | VAULT WATER (2) | GROUND-WATER (2)(3) | SURFACE SOIL | BOREHOLE/ SOIL SAMPLES | SAMPLE ANALYTE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | METALS | VOLs | SEMI-VOLs | RAD | WQ |
| T-1 | NA | NO | YES | 0 | 0 | 0 | 1 | 1/3 | - | - | - | X | - |
| T-2, T-3, | IHSS 122 | YES (T-3) | YES | 2 (T-3) | 1 | 4 | 5-GRAB 6-RF | 4/12 | X | X | X | X | X |
| T-7 | 159 | NO | YES | 0 | 0 | 4 | 0 | 4/12 | X | X | X | X | - |
| T-8 | NA | NO | YES | 0 | 0 | 4 | 0 | 4/12 | X | X | X | X | X |
| T-9 T-10 | NA | YES | YES | 2 (T-10) | 1 | 4 | 0 | 4/12 | X | X | X | X | X |
| T-11 T-30 | NA | NO | YES | 0 | 0 | 4 | 0 | 4/12 | X | X | X | X | - |
| T-14, T-16 | 124 and 125 | NO | YES | 2 | 0 | 5 | 0 | 5/25 | X | X | X | X | - |
| T-15, T-17 | 146 | NO | YES | 0 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| T-21, T-22 | NA | YES | YES | 3 | 2 | 4 | 0 | 4/12 | X | X | - | X | X |
| T-27 | NA | NA | YES | 0 | 0 | 0 | 0 | 0 | - | - | - | - | - |
| T-24, T-32, | NA | NO | YES | 0 | 0 | 2 | 0 | 2/6 | X | X | X | X | - |
| T-29 | NA | YES | YES | 2 | 1 | 4 | 2 GRAB | 4/12 | X | X | X | X | X |
| TOTAL | | | | 11 | 5 | 35 | 14 | 36/118 | | | | | |

Notes:
(1) Wipe samples will be analyzed only for qualitative radiological analysis
(2) Sample collected only if water is encountered
(3) Groundwater from the BAT(R) sampler will be analyzed for TCL volatiles.
HPGe = High purity Germanium
IHSS = Individual Hazardous Substance Site
NA = Not applicable
NaI = Sodium Iodide
No. = Number
Rad = Qualitative radiological analysis
RF = Rocky Flats Method
Vols = Volatiles
WQ = pH, specific conductivity, selected anions (nitrate/nitrite, sulfate, chloride, fluoride), total organic carbon (only for water samples)

### 3.2.1 Tank T-1

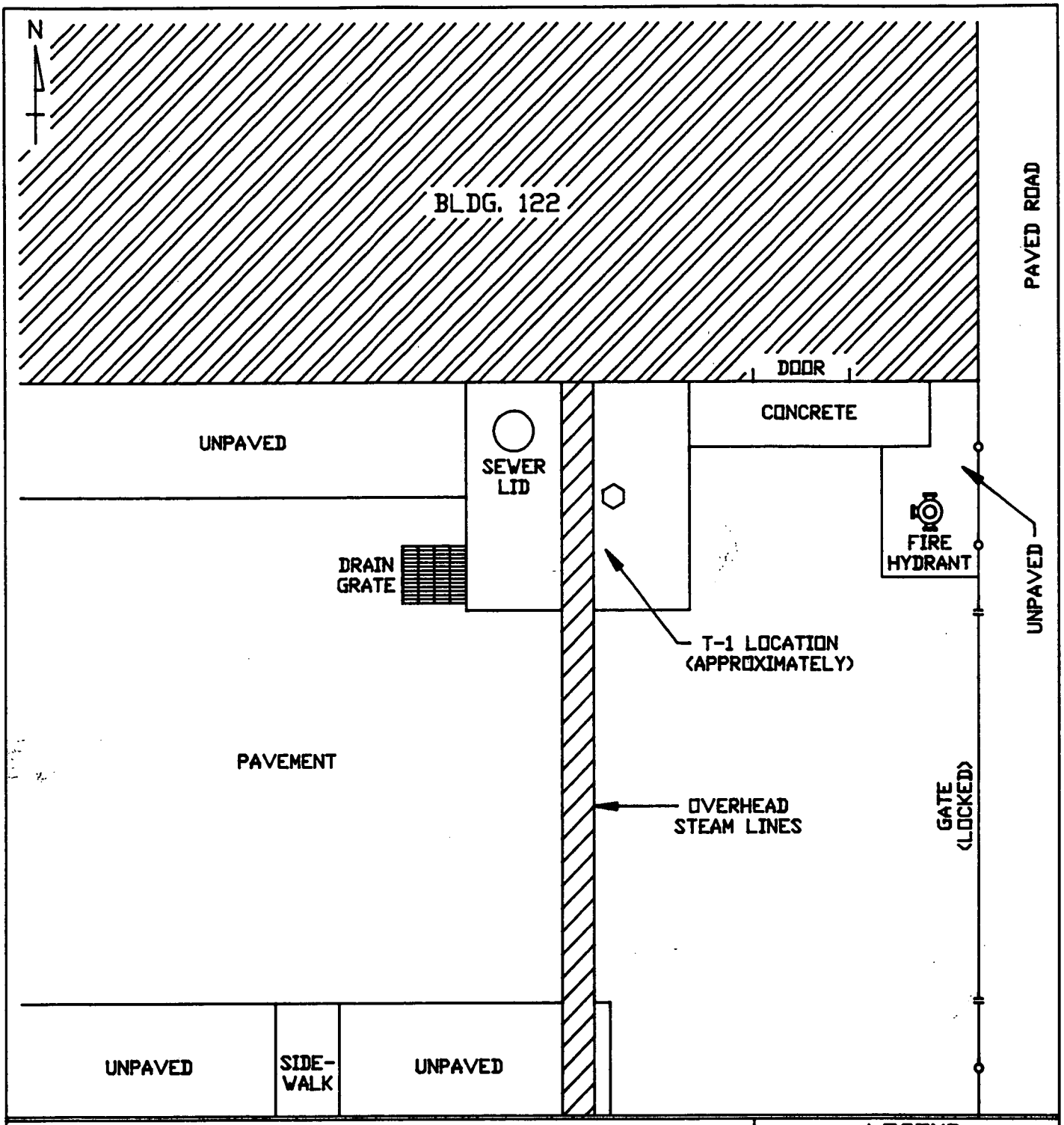
Tank T-1 is an 800-gallon, stainless steel underground tank that was removed in January 1984. The tank was located in the 100 Area, outside of Building 122 (the Medical Facility). It held waste streams from Building 122. The former tank area has been identified as a known release location. The primary waste streams were trace radionuclides and decontamination water (that included waste such as bleach, soap, blood, and hydrogen peroxide).

As part of the Stage 1 activities an HPGe radiological survey will be conducted. If the results of the HPGe survey show anomalies, then a NaI survey will be conducted using 10-foot grids.

One soil borehole will be drilled as closely as possible to the center of the original tank location. Three soil samples from the borehole will be collected at the following locations: ground surface (before drilling), 1 to 3 feet below the location of the base of the former tank (estimated at 11 to 15 feet below ground surface), and directly above the water table (estimated at 2 feet below ground surface). Sample locations are presented in Figure 3-1.

Soil samples will be analyzed for alpha spectrum and HPGe gamma. If the samples test positive for these constituents, further radiological analyses will include uranium 233, 234, 235, and 238; americium 241; and plutonium 239 and 240.

No groundwater samples are proposed using a BAT® sampler because a sufficient volume of water will not be produced for quantitative radionuclide analyses using this sampling device.




# FIGURE 3-1
# SAMPLE LOCATION FOR T-1

OPERABLE UNIT 9
ORIGINAL PROCESS WASTE LINES

ROCKY FLATS PLANT
GOLDEN, COLORADO

DATE: 9/20/93

LEGEND

- ⬡ - BOREHOLE
- △ - SURFACE SOIL
- □ - RESIDUAL
- ○ - WATER

NOT TO SCALE

### 3.2.2 Tanks T-2 and T-3

Tanks T-2 and T-3 are interconnected tanks located in the 400 Area, outside of Building 441. This location is also designated as IHSS 122. Tank T-2 is a 3,000-gallon, underground concrete tank located under Building 441. Tank T-3 consists of one 3,200-gallon, above-grade steel tank, and one 3,000-gallon, underground concrete tank with a concrete vault. All tanks were abandoned in June 1982. These tanks received waste streams from Building 122 (the Medical Facility), Building 123 (the Health Physics Analytical Laboratory), and Building 441 (the Analytical Laboratory). The locations of Tanks T-2 and T-3 have been identified as known release locations. Waste streams included acids, bases, solvents, radionuclides, metals, thiocyanate, ethylene glycol, trace polychlorinated biphenyls (PCBs), bleach, soap, blood, and hydrogen peroxide.

Stage 1 activities will include a visual tank inspection of the above-grade tank and the concrete vault at Tank T-3. No inspections will be conducted of the underground Tank T-2. An HPGe radiological survey will be conducted around the tank locations. If the results of the HPGe show anomalies, then a NaI radiological survey will be conducted on 10-foot grids.

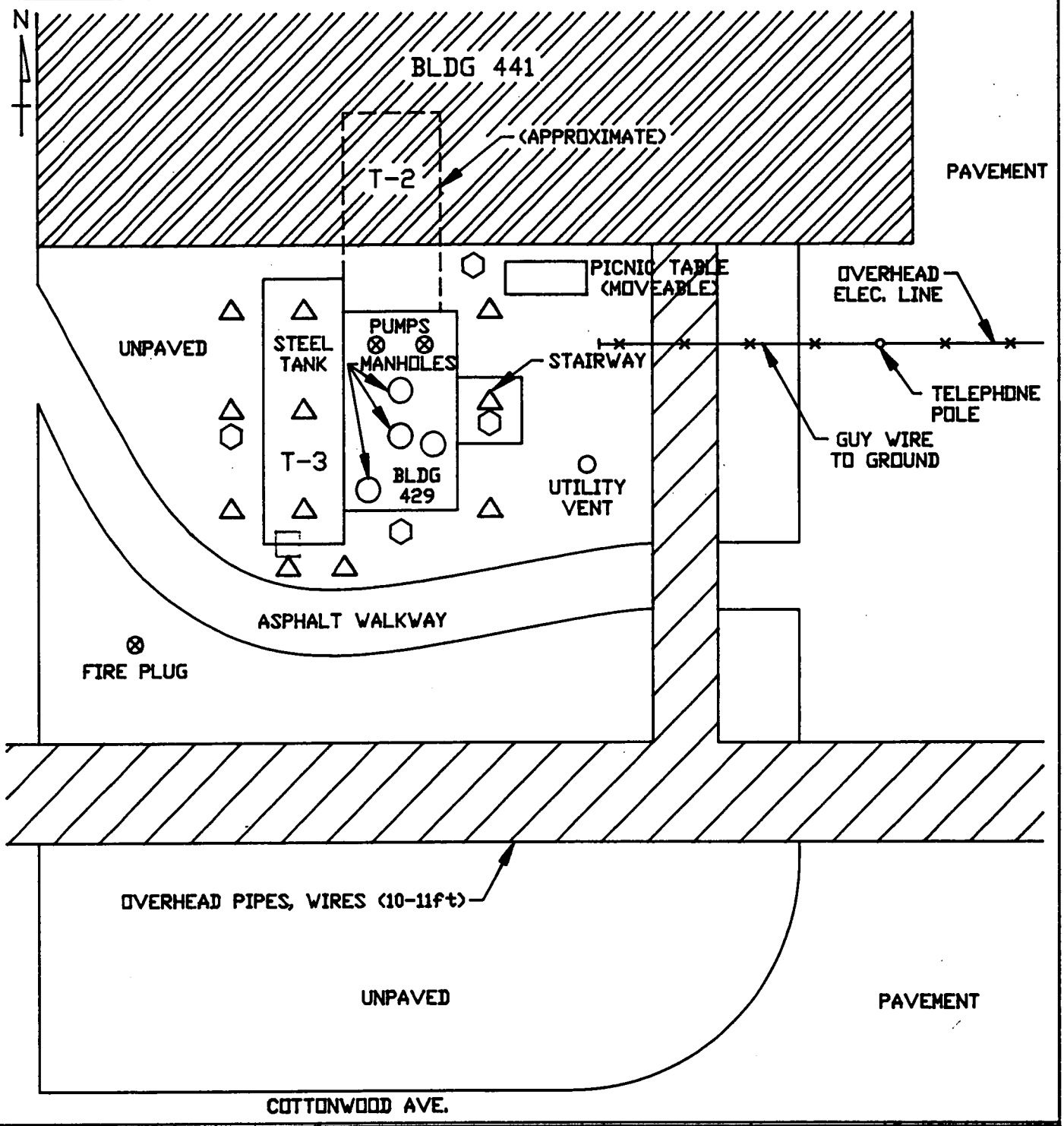
One residue sample will be collected from the above-grade tank. If no residue is present, one wipe sample will be taken from the tank interior for a qualitative radiological analysis. If there is groundwater in the concrete vault, a water sample will be collected. If no water is encountered in the vault, one wipe sample will be collected from the interior walls of the vault.

Five surface soil grab samples will be collected from potential spill or leak release locations around Tank T-3; three from discrete locations underneath the above-grade tank and two from pipe valve connections where leaks were likely to have occurred. Six composite samples will be collected using the RF method for radiological analyses from areas around the tanks where spills from tank overflow tank may have occurred.

Four soil boreholes will be drilled at each accessible side of the tank location. Three soil samples from each borehole will be collected from the following locations: ground surface (before drilling), 1 to 3 feet below the base of the tank(s) (estimated at 8 to 10 feet below ground surface), and directly above the water table (estimated at 1 to 3 feet below ground surface).

If groundwater is encountered in the boreholes, a BAT® sampler or equivalent will be used to collect a groundwater sample. Sample locations are presented in Figure 3-2.

Vault water, soil, and residue samples will be analyzed for alpha spectrum and HPGe gamma. If the samples test positive for these constituents, further radiological analyses will include uranium 233, 234, 235, and 238; americium 241; plutonium 239 and 240; and cesium 137. Chemical analyses include Target Analyte List (TAL) metals; TCL volatiles; TCL semi-volatiles; and water quality parameters such as pH, specific conductivity, nitrate/nitrite, sulfate, chloride, and total organic carbon (TOC). The wipe sample will be analyzed for qualitative radionuclides. Groundwater from the BAT® sampler will be analyzed for TCL volatiles.




# FIGURE 3-2
# SAMPLE LOCATIONS FOR T-2 & T-3

OPERABLE UNIT 9
ORIGINAL PROCESS WASTE LINES

ROCKY FLATS PLANT
GOLDEN, COLORADO

DATE: 9/20/93

LEGEND

- ⬡ - BOREHOLE
- △ - SURFACE SOIL
- □ - RESIDUAL
- ○ - WATER

NOT TO SCALE

### 3.2.3 Tank T-7

Tank T-7 is located in Building 528 (the Building 559 Process Waste Pit). This location is also designated as IHSS 159. Tank T-7 comprises two 2,000-gallon, in-sump steel tanks that are situated in an underground concrete vault.. Waste streams for Tank T-7 were from Building 559, (the Analytical Laboratory) and included acids, bases, solvents, radionuclides, metals, pesticides, herbicides, and potentially PCBs. Tank T-7 has been identified as a known release location at its connection with Pipe P-16.

According to building personnel, the tanks are undergoing RCRA closure. The tanks were used as 90-day transuranic waste tanks. The contents of the tanks were sampled (August 1993) to characterize closure requirements. The anticipated date of closure is 1 October 1993. Results of the tank characterization and closure requirements will be reviewed to determine the need for future sampling. Sample results will be incorporated into Technical Memorandum 2.

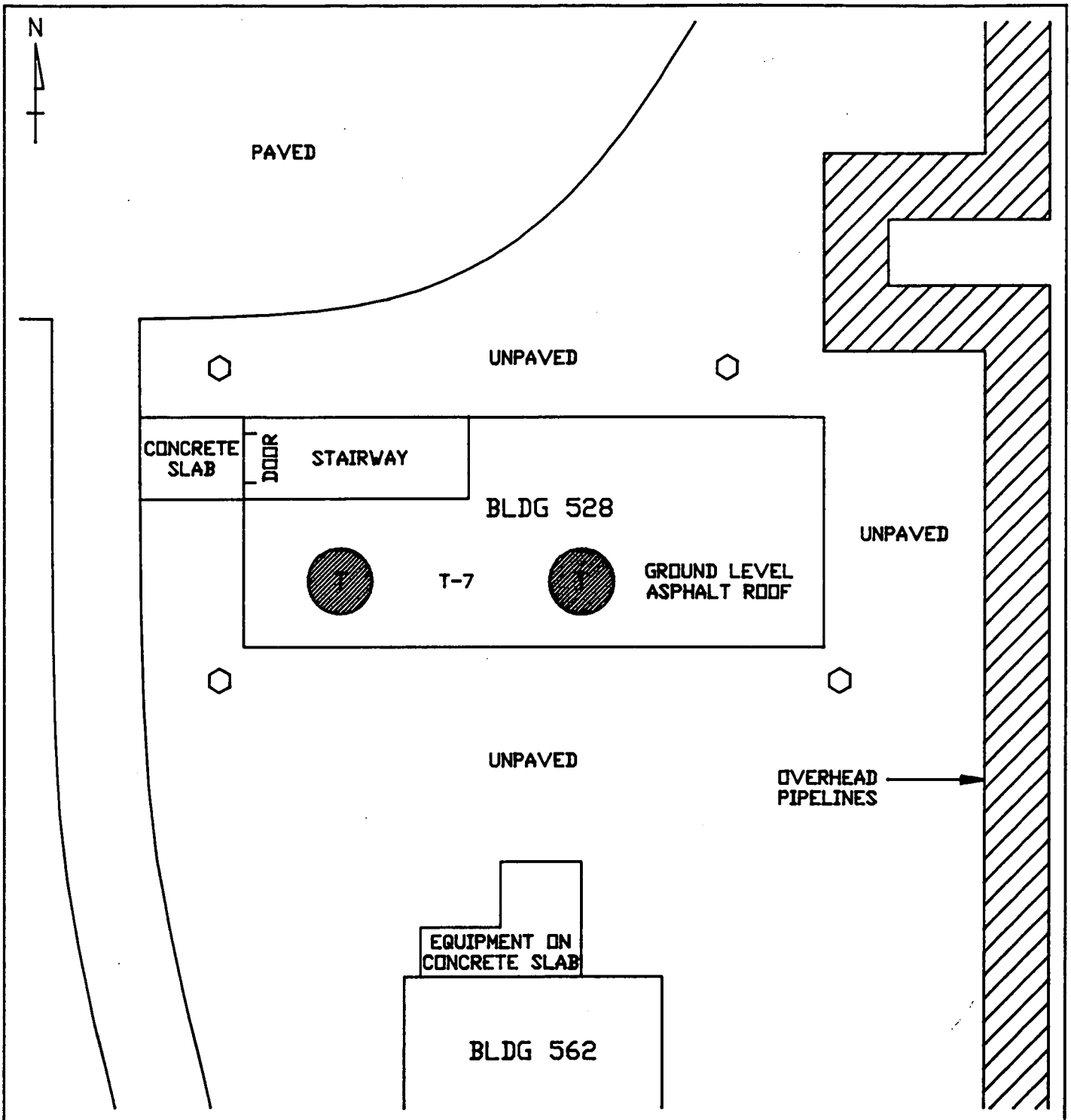
Stage 1 activities will include an HPGe radiological survey. If the results of the HPGe detect anomalies, then a NaI radiological survey will be conducted on 10-foot grids.

Four soil boreholes will be drilled at each accessible side of the tank location. Three soil samples from each borehole will be collected at the following locations: surface sample (0 to 6 inches), 1 to 3 feet below the base of the tanks (estimated at 25 to 30 feet below ground surface), and directly above the water table (estimated at 5 to 8 feet below ground surface).

If groundwater is encountered in the boreholes, a BAT® sampler or equivalent will be used to collect a groundwater sample. Due to the ongoing tank characterization being conducted by building personnel, no visual inspections or residue or wipe samples are proposed since the results of the current tank characterization will be incorporated when they are available. Also, information on past sampling conducted in this area in 1968 and 1972 will be reviewed

to supplement any additional sampling, if needed, in Stage 2. Sample locations are presented in Figure 3-3.

Soil samples will be analyzed for alpha spectrum and HPGe gamma. If the samples test positive for these constituents, further radiological analyses will include uranium 233, 234, 235, and 238; americium 241; and plutonium 239 and 240. Chemical analysis include TAL metals; TCL volatiles; and TCL semi-volatiles. Groundwater from the BAT® sampler will be analyzed for TCL volatiles.




# FIGURE 3-3
# SAMPLE LOCATIONS FOR T-7

OPERABLE UNIT 9
ORIGINAL PROCESS WASTE LINES

ROCKY FLATS PLANT
GOLDEN, COLORADO

DATE: 9/20/93

LEGEND

- BOREHOLE
- SURFACE SOIL
- RESIDUAL
- WATER

NOT TO SCALE

### 3.2.4 Tank T-8

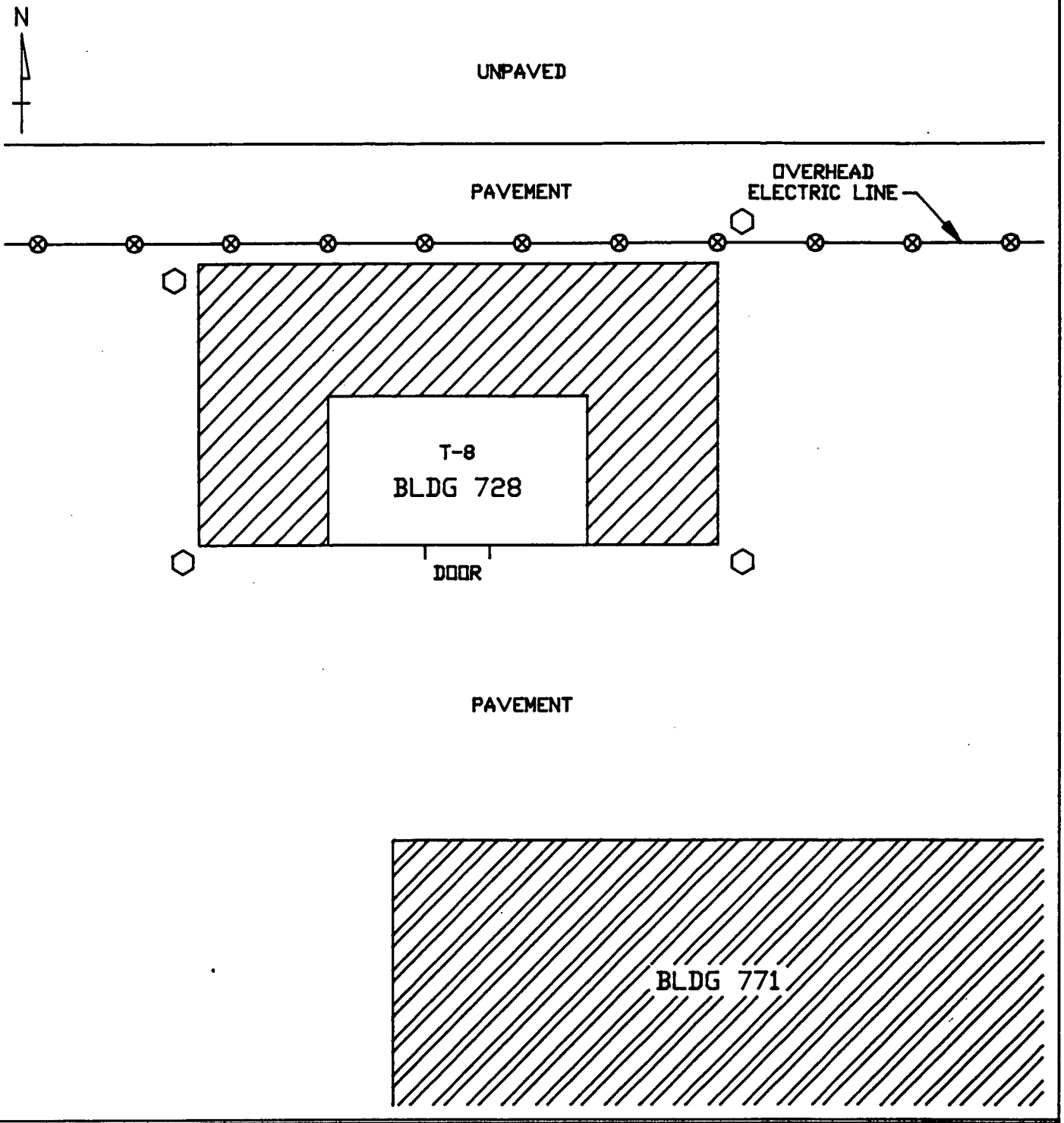
Tank T-8 is located in Building 728 (the Building 771 Process Waste Pit). This location is also designated as IHSS 126. Tank T-8 consists of two 25,000-gallon underground tanks. The tanks were taken out of service in May 1984, cleaned and painted, and converted to plenum deluge catch tanks for fire-water from Building 771. Waste streams for the tanks were from Building 771, (the Plutonium and Uranium Recovery Building). Waste streams included radionuclides, acids, bases, solvents, metals, fuel oil, lubricating oils, PCBs, and photography laboratory waste. The tanks periodically fill with groundwater and may have leaked when they were in use due to cracks in the concrete vault. Surface water also runs into Building 728 during periods of high runoff

Since the tanks now are actively used as plenum catch tanks, Stage 1 activities will focus on characterizing past releases that occurred when they were used to store process waste. Stage 1 activities will include an HPGe radiological survey. If the results of the HPGe indicate anomalies, then a NaI radiological survey will be conducted on 10-foot grids.

Four soil boreholes will be drilled at each accessible side of the tank location. Three soil samples from each borehole will be collected at the following locations: ground surface (before drilling), 1 to 3 feet below the base of the tanks (estimated at 20 to 25 feet below ground surface), and directly above the water table (estimated at 2 to 8 feet below ground surface).

If groundwater is encountered in the boreholes, a BAT® sampler or equivalent will be used to collect a groundwater sample. Currently, daily inspections of the tanks are conducted by plant personnel. Due to the ongoing tank inspections and the current use of the tanks, no visual inspections or residue or wipe samples are proposed for Stage 1 sampling. Sample locations are shown in Figure 3-4.

Vault water, soil, and residue samples will be analyzed for alpha spectrum and HPGe gamma. If the samples test positive for these constituents, further radiological analyses will include uranium 233, 234, 235, and 238; americium 241; plutonium 239 and 240; and tritium. Chemical analyses include TAL metals; TCL volatiles; TCL semi-volatiles; and water quality parameters such as pH, specific conductivity, nitrate/nitrite, sulfate, chloride, and TOC. Groundwater from the BAT® sampler will be analyzed for TCL volatiles.




# FIGURE 3-4
# SAMPLE LOCATIONS FOR T-8

OPERABLE UNIT 9
ORIGINAL PROCESS WASTE LINES

ROCKY FLATS PLANT
GOLDEN, COLORADO

DATE: 9/20/93

LEGEND

- ⬡ - BOREHOLE
- △ - SURFACE SOIL
- □ - RESIDUAL
- ○ - WATER

NOT TO SCALE

### 3.2.5 Tanks T-9 and T-10

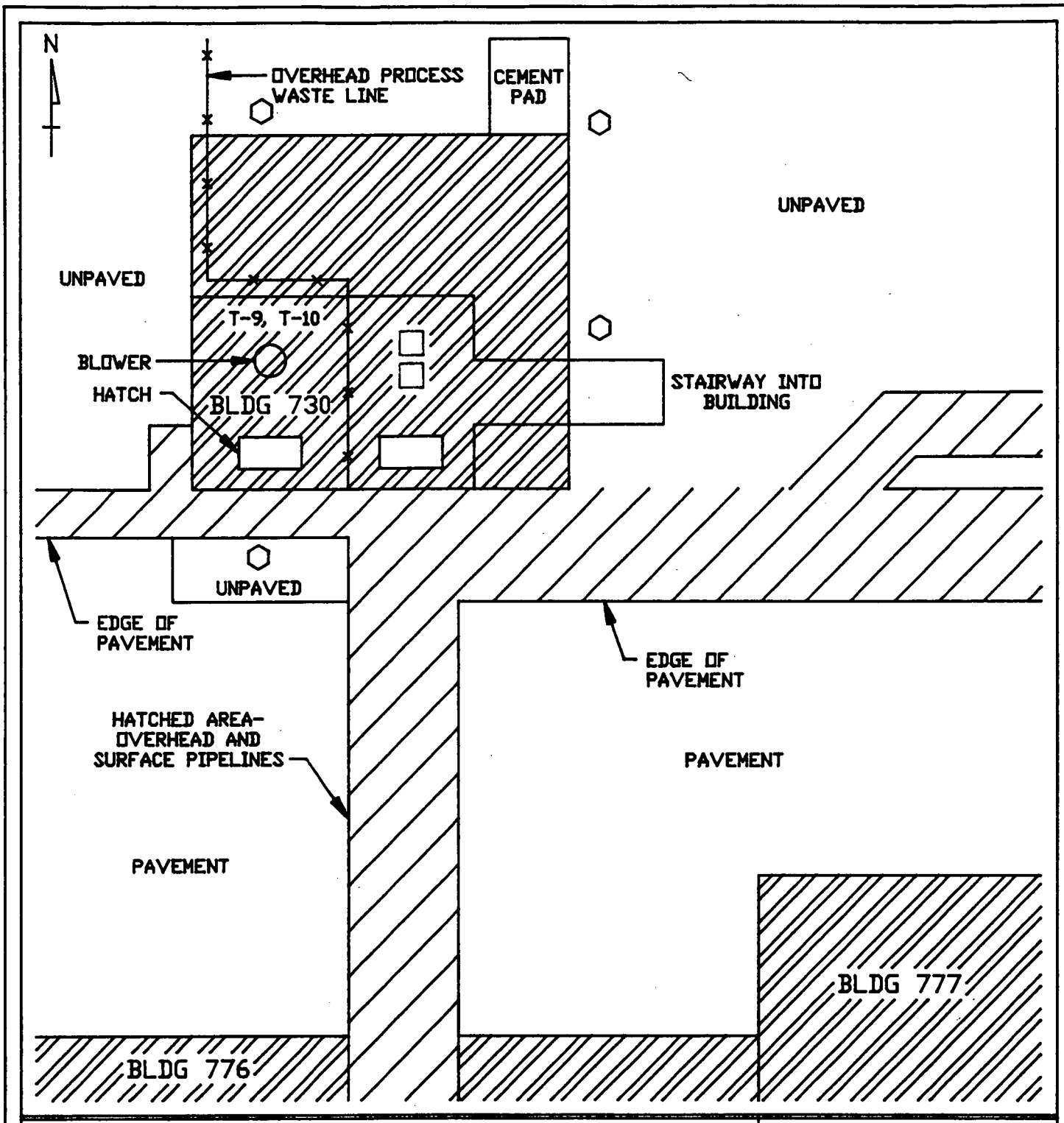
Tanks T-9 and T-10 are located in Building 730 (the Building 776 Process Waste Pit). This location is also designated as IHSS 132. Tank T-9 consists of two 22,550-gallon, underground concrete tanks with the dimensions of 25 feet by 15 feet by 10 feet. Tanks T-9 are known as the Laundry Waste Holding Tanks. These tanks were taken out of service in October 1984, cleaned and painted, and converted to plenum deluge catch tanks. Tanks T-10 consist of two 4,500-gallon, underground concrete tanks with the dimensions of 5 feet by 5 feet by 10 feet. These tanks are the Process Waste Holding Tanks. Tanks T-10 were abandoned in December 1982; however, they have not been cleaned or painted since being removed from service. The tanks are currently used as a plenum deluge catch tanks. Waste streams for Tanks T-9 and T-10 were from Building 776 (Production Support) and Building 778 (Laundry). Waste streams included radionuclides, solvents, metals, and small amounts of machinery and lubricating oils. Releases from the tanks are considered as likely due to the condition of the tanks.

Stage 1 activities will include a visual inspection of tanks. An HPGe survey radiological survey will be conducted around the tank locations. If the results of the HPGe show anomalies, then a NaI radiological survey will be conducted on 10-foot grids.

One residue sample will be collected from the Tank T-10 tanks that have not been cleaned and painted. If no residue is present, then one wipe sample will be taken from the tank interior for radiological analysis. If groundwater is found in the concrete vault, a water sample will be collected.

Four soil boreholes will be drilled at each accessible side of the tank location. Three soil samples from each borehole will be collected at the following locations: ground surface (before drilling), 1 to 3 feet below the base of the tanks (estimated at 20 to 25 feet below ground surface), and directly above the water table (estimated at 11 to 15 feet below ground

surface). If groundwater is encountered in the boreholes, a BAT® sampler or equivalent will be used to collect a groundwater sample. Sample locations are provided in Figure 3-5. Vault water, soil, and residue samples will be analyzed for alpha spectrum and HPGe gamma. If the samples test positive for these constituents, further radiological analyses will include uranium 233, 234, 235, and 238; americium 241; plutonium 239 and 240; and tritium. Chemical analyses include TAL metals; TCL volatiles; TCL semi-volatiles; and water quality parameters such as pH, specific conductivity, nitrate/nitrite, sulfate, chloride, and TOC. Wipe samples will be analyzed for qualitative radionuclides. Groundwater from the BAT® sampler will be analyzed for TCL volatiles.




# FIGURE 3-5
# SAMPLE LOCATIONS FOR T-9 & T-10

OPERABLE UNIT 9
ORIGINAL PROCESS WASTE LINES

ROCKY FLATS PLANT
GOLDEN, COLORADO

DATE: 9/20/93

LEGEND
- ⬡ - BOREHOLE
- △ - SURFACE SOIL
- □ - RESIDUAL
- ○ - WATER

NOT TO SCALE

### 3.2.6 Tanks T-11 and T-30

Tanks T-11 and T-30 are located in Building 731 (the Building 707 Process Waste Pit). Tank T-11 consists of two 2,000-gallon closed-top sumps. Tank T-30 is one 23,113-gallon, underground concrete sump. Both Tanks T-11 and T-30 are active incidental spill control units. Waste streams for Tanks T-11 and T-30 are from Building 707 (Plutonium Production). Waste streams include radionuclides, solvents, metals, lubricating oils, lathe coolant (mixture of oil and carbon tetrachloride [$CCl_4$]), and ethylene glycol. Tank T-11 is identified as a known release location.

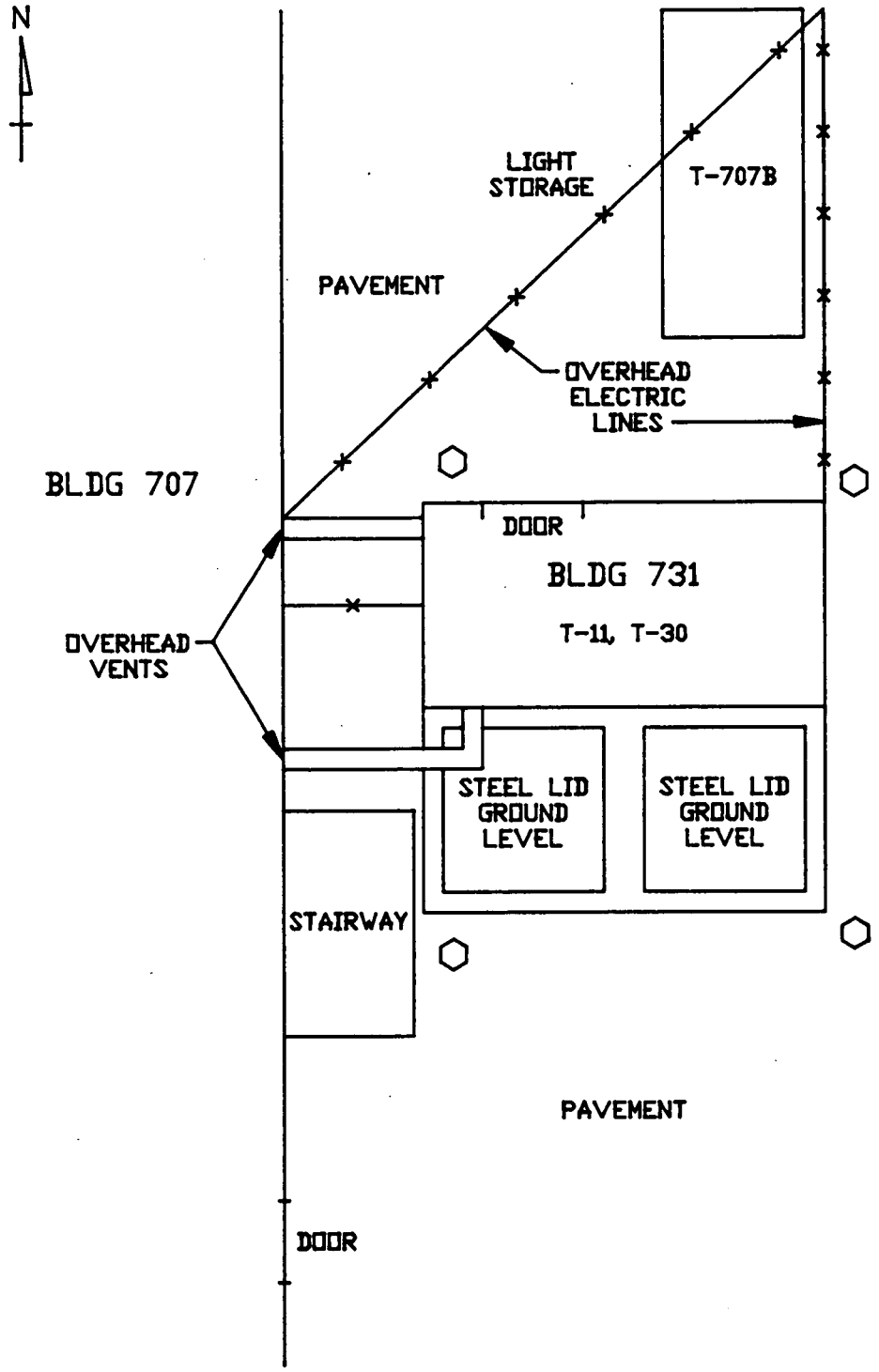
Since the tanks are actively used as RCRA units, Stage 1 activities will focus on characterizing past releases from the tanks. These activities will include an HPGe radiological survey. If the results of the HPGe detect anomalies, then a NaI radiological survey will be conducted on 10-foot grids.

Four soil boreholes will be drilled at each accessible side of the tank location. Three soil samples from each borehole will be collected at the following locations: ground surface (before drilling), 1 to 3 feet below the base of the tanks (estimated at 11 to 15 feet below ground surface) and directly above the water table (estimated at 5 feet below ground surface).

If groundwater is encountered in the boreholes, a BAT® sampler or equivalent will be used to collect a groundwater sample. Currently, daily inspections of the tanks are conducted by plant personnel. Due to the ongoing tank inspections and the current use of the tanks, no visual inspections or residue or wipe samples are proposed for Stage 1 sampling. Sample locations are presented in Figure 3-6.

Soil samples will be analyzed for alpha spectrum and HPGe gamma. If the samples test positive for these constituents, further radiological analyses will include uranium 233, 234, 235, and 238; americium 241; plutonium 239 and 240; and tritium. Chemical analyses

include TAL metals, TCL volatiles, and volatiles. Groundwater from the BAT® sampler will be analyzed for TCL volatiles.




# FIGURE 3-6
# SAMPLE LOCATIONS FOR T-11 & T-30

OPERABLE UNIT 9
ORIGINAL PROCESS WASTE LINES

ROCKY FLATS PLANT
GOLDEN, COLORADO

DATE: 9/20/93

LEGEND

- ⬡ - BOREHOLE
- △ - SURFACE SOIL
- □ - RESIDUAL
- ○ - WATER

NOT TO SCALE

### 3.2.7 Tanks T-14 and T-16

Tanks T-14 and T-16 are located on the east side of Building 774 in a chemical storage shed. This is the same location as IHSSs 124.1 through 124.3, and IHSS 125. Tank T-14 consists of one 30,000-gallon, underground concrete tank. Tank T-16 consists of two 14,000 gallon, underground concrete tank. Tank T-14 and Tank T-16 are designated as RFP Tanks 68, 66, and 67, respectively. Previous data indicate the tanks were abandoned in November 1989. Other data (DOE, 1992b) indicate the tanks were closed in compliance with RCRA closure requirements. However, during the site walk conducted on 29 July 1993, data sheets posted on the shed containing the T-16 tanks indicate that they may be active RCRA units.

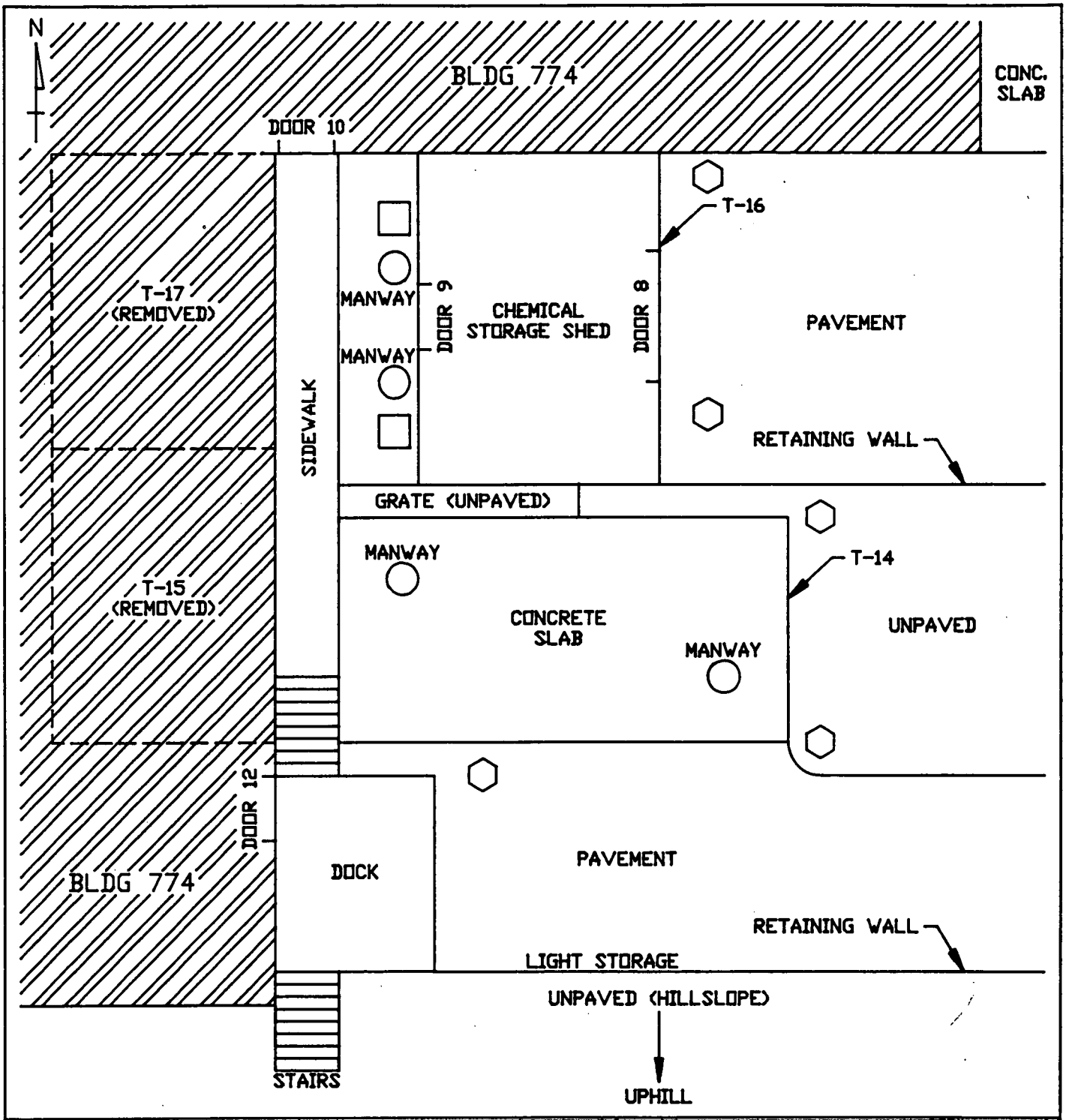
Tanks T-14 and T-16 received waste streams from Building 774 (the Process Waste Treatment Facility). Waste streams included acids, bases, radionuclides, metals, and other wastes used at RFP. Both Tanks T-14 and T-16 have been identified as release locations where tank overflow was documented in 1980 and 1981. The HRR (DOE, 1992b) indicates that a radiation survey was conducted from 1977 to 1984, but the results were not provided in the report.

Stage 1 activities will focus on characterizing any past releases from the tanks, and will include an HPGe radiological survey. If the results of the HPGe survey detect anomalies, then a NaI radiological survey will be conducted on 10-foot grids.

Five soil boreholes will be drilled down-gradient of the tank locations. Since contaminated soil has been detected in this area, five soil samples from each borehole will be collected at the following locations: ground surface (before drilling); and one composite sample at each 2-foot interval to a depth of 10 feet below the base of the tanks, or until the water table or bedrock is encountered. The water table at this location is estimated to be at 5 to 8 feet below ground surface. Therefore, it is estimated that samples will be collected from depths of 2, 4, 6, and 8 feet in each borehole.

If groundwater is encountered in the boreholes, a BAT® sampler or equivalent will be used to collect a groundwater sample. Interviews will be conducted with plant personnel to verify that Tanks T-16 are RCRA units. If the tanks are included in a RCRA program with daily tank inspections, no visual inspections or residue or wipe samples will be proposed for Stage 1 sampling. If the tanks are not active, a visual inspection will be conducted and one residue or wipe sample will be collected from each tank. Sample locations are shown in Figure 3-7.

Soil and residue samples will be analyzed for alpha spectrum and HPGe gamma. If the samples test positive for these constituents, further radiological analyses will include uranium 233, 234, 235, and 238; americium 241; plutonium 239 and 240; and tritium. Chemical analyses include TAL metals, TCL volatiles, and TCL semi-volatiles. Wipe samples, if collected, will be analyzed for qualitative radionuclides. Groundwater from the BAT® sampler will be analyzed for TCL volatiles.




# FIGURE 3-7
# SAMPLE LOCATIONS FOR T-14, T-15, T-16 AND T-17

OPERABLE UNIT 9
ORIGINAL PROCESS WASTE LINES

ROCKY FLATS PLANT
GOLDEN, COLORADO

DATE: 9/20/93

LEGEND

- ⬡ - BOREHOLE
- △ - SURFACE SOIL
- □ - RESIDUAL
- ○ - WATER

NOT TO SCALE

### 3.2.8 Tanks T-15 and T-17

Tanks T-15 and T-17 were located beneath the south wing of Building 774. This location is also designated as IHSS 149. Tank T-15 consisted of two 7,500-gallon, underground concrete tanks. Tank T-17 consisted of four 3,750-gallon, underground concrete tanks. All tanks were taken out of service and removed when the south wing of Building 774 was built in 1972. The south wing overlies the former tank locations. Tanks T-15 and T-17 have been identified as known release locations. Contaminated soil from this area was removed in 1972 during construction of the south wing. The contaminated soil was piled north of Building 334 (currently IHSS 156.1), and later moved to the area called the triangle area (IHSS 165). Sixty yards of contaminated soil from this area were also used as fill dirt east of Building 881 (currently IHSS 130). IHSSs 156.1, 165 and 881 are being investigated under other OUs.

Stage 1 activities will include an HPGe radiological survey. If the results of the HPGe detect anomalies, a NaI radiological survey will be conducted on 10-foot grids. Since soil boreholes will be drilled directly east of the south wing for Tanks T-14 and T-16, no additional soil boreholes are proposed for Stage 1 activities as these locations should detect any historical releases from Tanks T-15 and T-17. Tanks T-15 and T-17 are shown in Figure 3-7.

Future Stage 2 activities will be used to further define potential areas of contamination and differentiate potential contamination from Tanks T-14 and T-16, and Tanks T-15 and T-17.

### 3.2.9 Tanks T-21 and T-22

Tanks T-21 and T-22 are located in Building 828 (the Building 886 Process Waste Pit). Tank T-21 is a 250-gallon, concrete floor sump. Tank T-22 consists of two 250-gallon, steel tanks that are situated in an underground concrete vault. Tanks T-21 and T-22 held waste from the laboratories in Building 886. Waste streams included radionuclides, laboratory soaps, janitorial cleaning fluids, and possibly nitrates. Tank T-21 held overflow from Tank T-22 and groundwater infiltrating Building 828. The tanks were abandoned in 1978. There are no known releases at this location.

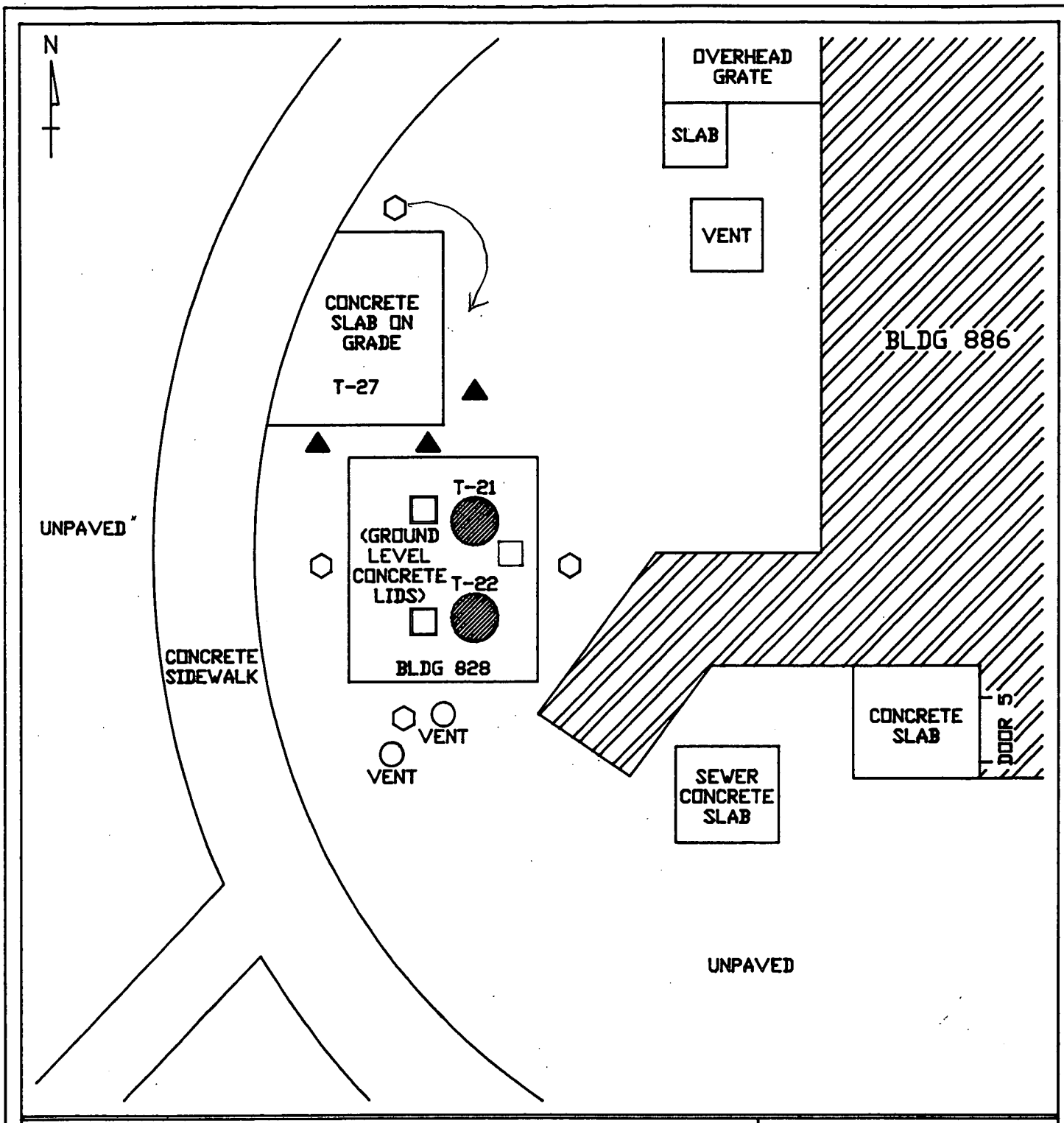
Stage 1 activities will include a visual tank inspection of the tanks. An HPGe radiological survey will be conducted around the tank locations. If the results of the HPGe detect anomalies, a NaI radiological survey will be conducted on 10-foot grids.

Four soil boreholes will be drilled at each accessible side of the tank location. Three soil samples from each borehole will be collected at the following locations: ground surface (before drilling), 1 to 3 feet below the base of the tanks (estimated at 20 to 25 feet below ground surface), and directly above the water table (estimated at 15 to 20 feet below ground surface).

If groundwater is encountered in the boreholes, a BAT® sampler or equivalent will be used to collect a groundwater sample. One residue sample will be collected from each tank and from the sump. If no residue is present, one wipe sample will be taken from the interiors of the tanks and sumps for radiological analysis. If groundwater has filled the pit or tanks, a water sample will be collected. Sample locations are shown in Figure 3-8.

Vault water, soil, and residue samples will be analyzed for alpha spectrum and HPGe gamma. If the samples test positive for these constituents, further radiological analyses will include uranium 233, 234, 235, and 238; americium 241; and plutonium 239 and 240. Chemical analyses include TAL metals; TCL volatiles; and water quality parameters such

as pH, specific conductivity, nitrate/nitrite, sulfate, chloride, and TOC. Wipe samples, if collected, will be analyzed for qualitative radionuclides. Groundwater from the BAT® sampler will be analyzed for TCL volatiles.




# FIGURE 3-8
# SAMPLE LOCATIONS FOR T-21, T-22 AND T-27

OPERABLE UNIT 9
ORIGINAL PROCESS WASTE LINES

ROCKY FLATS PLANT
GOLDEN, COLORADO

DATE: 9/20/93

LEGEND

- ⬡ - BOREHOLE
- ▲ - PREVIOUS SURFACE SOIL LOCATION
- □ - RESIDUAL
- ○ - WATER

NOT TO SCALE

### 3.2.10 Tank T-27

Tank T-27 is a 500-gallon portable tank that was located on a concrete pad outside of Building 886. The tank was used to store and transfer Building 886 process waste. Waste was pumped from Tanks T-21 and T-22 (described above) to Tank T-27 and transported, via truck, to the waste treatment facility. Tank T-27 was decontaminated, removed, and sent to the size reduction building for disposal after a state employee noted a wet area, approximately 4 to 5 inches in diameter, under the bottom drain valve of the tank. Subsequently, radiation surveys were conducted on and around the concrete pad and soil from around the pad was collected and analyzed. Results of the soil samples showed only low levels of naturally occurring uranium. Nonremovable contamination detected on the pad was fixed in place with spray paint. However, at the time of the site walk, the area in the concrete appeared to have been chipped out. Since Tank T-27 has been removed, the area of investigation for Tank T-27 is the concrete pad. Documentation obtained from Dr. Bob Rothe (of RFP's Critical Mass Laboratory Building 886) shows that soil samples around the pad indicate no contamination as a result of the leak (see Appendix B).

Stage 1 activities include an HPGe radiation survey to verify that no radiation contamination exists on or around the concrete pad. The HPGe survey area is presented in Figure 3-8.

### 3.2.11 Tanks T-24 and T-32

Tanks T-24 and T-32 are located in Building 887 (the Building 881 Process Waste Pit). Tank T-24 consists of seven 2,700-gallon, above-grade steel tanks situated within Tank T-32, a concrete vault. Tank T-32 is a 131,160-gallon underground sump. Both Tanks T-24 and T-32 are active RCRA units. Waste streams for Tanks T-24 and T-32 are from Building 881 and consist of acids, bases, radionuclides, and solvents. There have been no reported releases from these tanks.

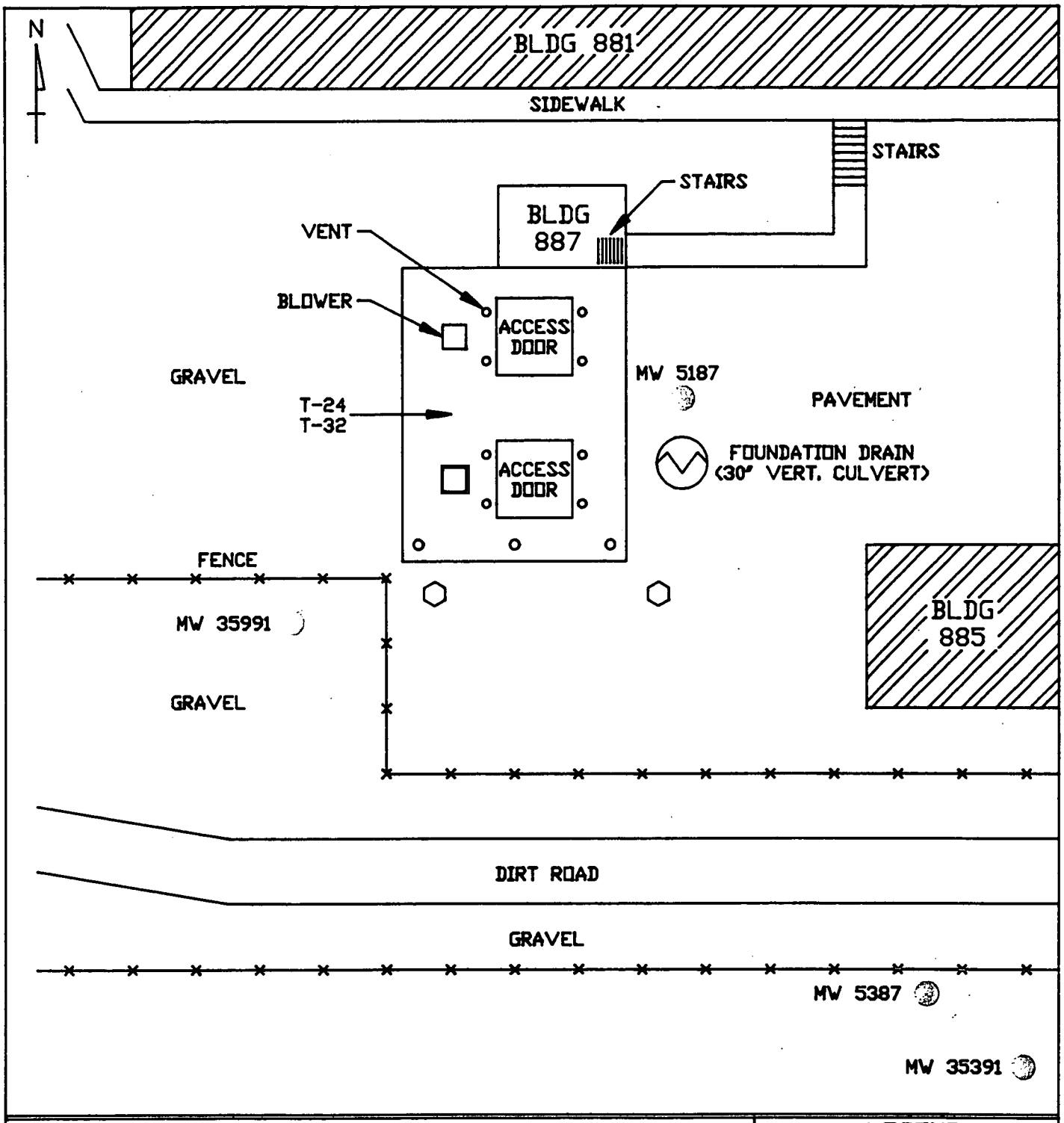
Since the tanks are actively used as RCRA units, Stage 1 activities will focus on characterizing any past releases from the tanks. Stage 1 activities will include an HPGe radiological survey. If the results of the HPGe indicate anomalies, a NaI radiological survey will be conducted on 10-foot grids.

Two soil boreholes will be drilled at the down-gradient side of the tank location that is accessible to sampling. Three soil samples from each borehole will be collected at the following locations: ground surface (before drilling) 1 to 3 feet below the base of the tanks (estimated at 25 to 30 feet below ground surface), and directly above the water table (estimated at 5 to 8 feet below ground surface).

If groundwater is encountered in the boreholes, then a BAT® sampler or equivalent will be used to collect a groundwater sample. Currently, daily inspections of the tanks are conducted by plant personnel. Due to the ongoing tank inspections and current use of the tanks, no visual inspections or residue or wipe samples are proposed for Stage 1 sampling. Sample locations are provided in Figure 3-9.

Soil samples will be analyzed for alpha spectrum and HPGe gamma. If the samples test positive for these constituents, further radiological analyses will include uranium 233, 234, 235, and 238; americium 241; and plutonium 239 and 240. Chemical analyses include TAL

metals, TCL volatiles, and TCL semi-volatiles. Groundwater from the BAT® sampler will be analyzed for TCL volatiles.




# FIGURE 3-9
# SAMPLE LOCATIONS FOR T-24 & T-32

OPERABLE UNIT 9
ORIGINAL PROCESS WASTE LINES

ROCKY FLATS PLANT
GOLDEN, COLORADO

DATE: 9/20/93 NOT TO SCALE

LEGEND

- ⬡ - BOREHOLE
- ◍ - EXISTING MONITORING WELL
- △ - SURFACE SOIL
- □ - RESIDUAL
- ○ - WATER

### 3.2.12 Tank T-29

Tank T-29 is a 200,000-gallon, on-grade steel tank located south of Building 774 (Process Waste Treatment). Tank T-29 was used to store untreated process waste from Building 774. Records indicate that it was abandoned in the mid-1980s (DOE, 1992a). The waste stream from Building 774 included acids, bases, solvents, radionuclides, metals, chlorides, oils, and grease. There are no reported releases from this tank.

As part of Stage 1 activities a visual tank inspection will be conducted. An HPGe radiological survey will be conducted around the tank locations. If the results of the HPGe detect anomalies, a NaI radiological survey will be conducted on 10-foot grids.

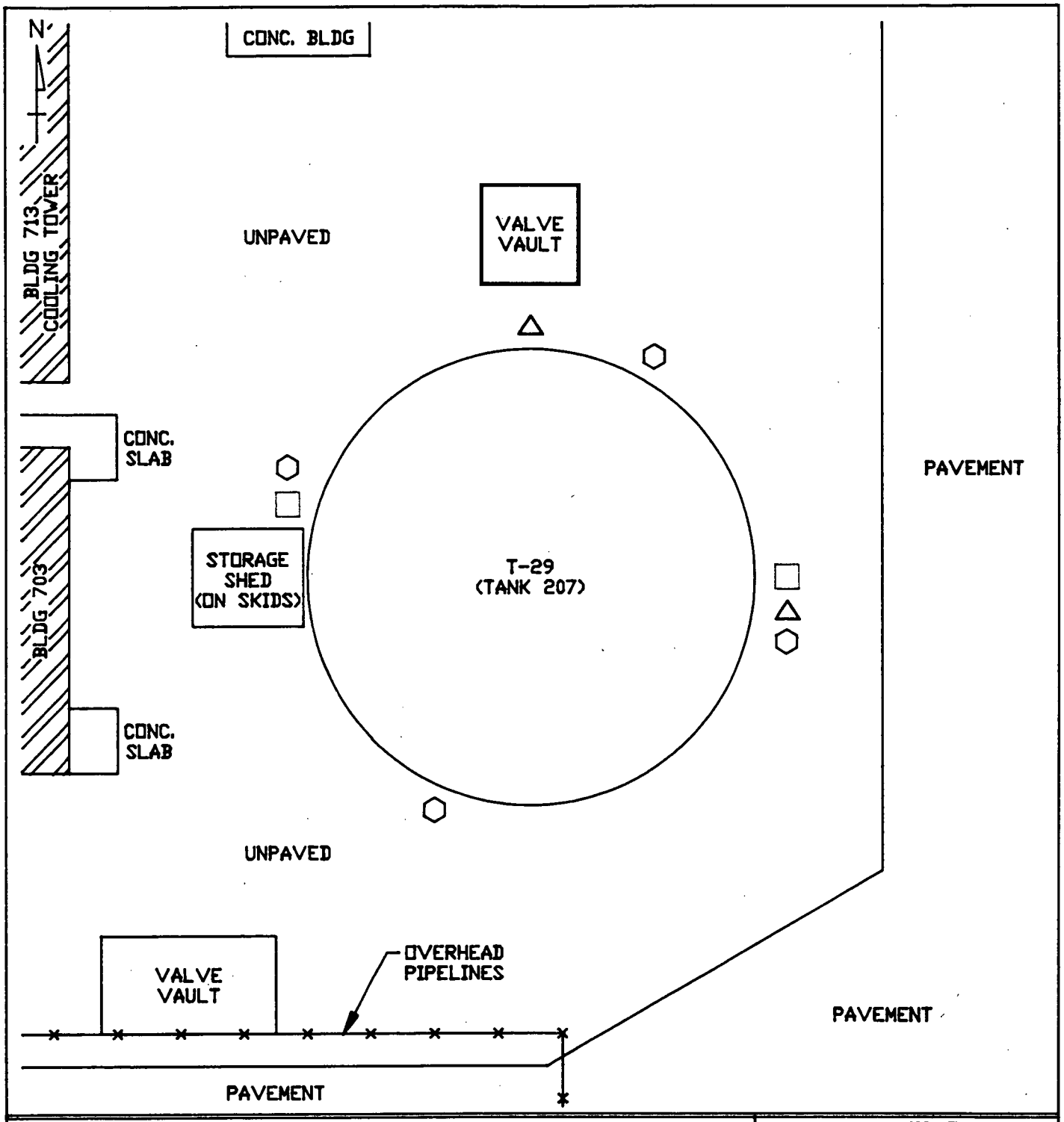
Two residue samples will be collected; one from an open outflow pipe and one from the tank's manway opening. Two surface soil grab samples will be collected: one from under the open outflow pipe and one from beneath a pipe with a welded seam that indicates a rupture may have occurred.

A water sample may be collected from the valve vault north of Tank T-29 if groundwater is encountered in the vault.

Four soil boreholes will be drilled at each accessible side of the tank location. Three soil samples from each borehole will be collected at the following locations: ground surface (before drilling), mid-depth between the ground surface and the water table, and directly above the water table (estimated at 2 to 8 feet below ground surface). If groundwater is encountered in the boreholes, a BAT® sampler or equivalent will be used to collect a groundwater sample. Sample locations are presented in Figure 3-10.

Vault water and soil samples will be analyzed for alpha spectrum and HPGe gamma. If the samples test positive for these constituents, further radiological analyses will include uranium 233, 234, 235, and 238; americium 241; and plutonium 239 and 240. Chemical analyses

include TAL metals; TCL volatiles; TCL semi-volatiles; and water quality parameters such as pH, specific conductivity, nitrate/nitrite, sulfate, chloride, and TOC. Wipe samples, if collected, will be analyzed for qualitative radionuclides. Groundwater from the BAT® sampler will be analyzed for TCL volatiles.




# FIGURE 3-10
# SAMPLE LOCATIONS FOR T-29

OPERABLE UNIT 9
ORIGINAL PROCESS WASTE LINES

ROCKY FLATS PLANT
GOLDEN, COLORADO

DATE: 9/20/93

LEGEND

- ⬡ - BOREHOLE
- △ - SURFACE SOIL
- □ - RESIDUAL
- ○ - WATER

NOT TO SCALE

## 4.0 FIELD PROCEDURES

Field procedures and required equipment for borehole drilling and soil sampling are specified in EMD OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques. Before any boreholes are drilled, the location will be cleared for utilities in accordance with EMD OP GT.10, Borehole Clearing. Surface soil samples will be collected as specified in EMD OP GT.08, Surface Soil Sampling. Equipment needed for surface soil sampling is specified in EMD OP GT.08. The locations of all boreholes and surface soil sampling points will be surveyed using standard land surveying techniques described in the EMD OP GT.17, Land Surveying. Residue samples will be collected in accordance with EMD OP FO.28, Tank and Pipeline Investigation For RFI/RI. Wipe samples will be collected and tested according to EMD OP FO.16, Field Radiological Measurements. The BAT® groundwater samples will be collected according to EMD OP ST.22, In-Situ Sampling with BAT® Sampling. Incidental water samples from tank and valve vaults will be collected according to EMD OP SW.16, Sampling of Incidental Waters. Decontamination will be in accordance with EMD OP FO.03, General Equipment Decontamination; and EMD FO.04, Heavy Equipment Decontamination. Disposal of decontamination water will be in accordance with EMD OP FO.07, Handling of Decontamination Water and Waste Water. Sample labeling, shipment, and preservation will be conducted according to EMD OP FO.13, Containerization, Preserving, Handling, and Shipping of Soil and Water Samples. Sample designations, documentation, data package preparation, and sample tracking will be in accordance with EMD OP FO.14, Field Data Management. A list of all EMD OPs applicable to Stage 1 sampling activities is presented in Table 4-1.

A summary of Phase I tank investigation sampling field methods is provided below. Details of the methods are given in the EG&G operating procedures.

1. The radiation survey results must satisfy the prework area radiation monitoring requirements and forms FO.16A and FO.16B must be completed OP FO.16.

# TABLE 4-1
# OPERATING PROCEDURES
# OU9 ORIGINAL PROCESS WASTE LINES

| Procedure | Name |
|---|---|
| EMD OP GT.02 | Drilling and Sampling Using Hollow-stem Auger Techniques |
| EMD OP GT.08 | Surface Soil Sampling |
| EMD OP GT.10 | Borehole Clearing |
| EMD OP GT.17 | Land Surveying |
| EMD OP SW.16 | Sampling of Incidental Waters |
| EMD OP ST.22 | In Situ Sampling with BAT® Sampling |
| EMD OP FO.03 | General Equipment Decontamination |
| EMD OP FO.04 | Heavy Equipment Decontamination |
| EMD OP FO.07 | Handling of Decontamination Water and Wash Water |
| EMD OP FO.13 | Containerization, Preserving, Handling and Shipping of Soil and Water Samples |
| EMD OP FO.14 | Field Data Management |
| EMD OP FO.16 | Field Radiological Measurements |
| EMD OP FO.28 | Tank and Pipeline Investigation for RFI/RI |

Notes:
OU = Operable Unit
EMD = Environmental Management Department
OP = Operating Procedure
RFI/RI = RCRA Facility Investigation/Remedial Investigation
RCRA = Resource Conservation and Recovery Act

2. Utility clearances must be completed, before drilling begins, according to EMD OP GT.10.

3. The following decontamination equipment must be assembled for field use as required by EMD OP FO.03: liquinox, bristle brushes (all plastic), RFP tap water or distilled water, nonreactive plastic wrap, plastic wash and rinse tubs, plastic sheeting for use as a ground cloth, and paper towels.

4. The following sampling equipment must be obtained as required by EMD OP FO.13: sample glassware with preservative (as described in Section 5.0), coolers, thermometer, blue ice, sample labels, chain-of-custody forms, custody seals, zip-lock bags, bubble wrap, vermiculite, strapping tape, clear tape, and a carboy to transport rinsate.

5. Borehole drilling and sampling will be in accordance with EMD OP GT.02.

6. Before and after drilling and sampling take place, all equipment must be decontaminated in accordance with the procedures outlined in the EMD OPs FO.03 and FO.04. Disposal of decontamination water shall be in accordance with EMD OP FO.07.

7. Incidental water samples from the tank and valve vaults will be collected according to EMD OPs SW.02 and SW.16.

8. The BAT® groundwater sampler will be used to collect grab groundwater samples from the top of the water table during borehole activities. The groundwater samples will be collected according to EMD OP ST.22, In-Situ Sampling with BAT ® Sampling.

9. Surface soil samples will be collected according to EMD OP GT.08. Two types of surface soil samples will be collected. Surface soil samples for radiological and conventional analyses will consist of compositing 10 soil samples collected from the center and each corner of two 1-meter squares that are spaced 1 meter apart at each sample location. The second type of surface soil sample is the grab sample which is collected from one discrete sample location.

10. Residual samples will be collected according to EMD OP FO.28.

11. Wipe samples will be collected and tested according to EMD OP FO.16. This will be a quantitative measure of radionuclide contamination.

12. All drill cuttings, soil samples, and water samples will be monitored for radionuclides and organic vapors in accordance with EMD OP FO.15 and EMD OP FO.06. These procedures are described in the Integrated Health and Safety Plan. Investigation-derived wastes, such as drill cuttings and residual samples, will be handled according to guidelines in EMD OPs FO.08 and FO.09.

13. The locations of all boreholes and sample points will be paced and/or taped off before sampling or drilling. After sampling or drilling, locations will be surveyed using standard land surveying techniques described in EMD OP GT.17. Horizontal accuracy will be $\pm$ 0.5 foot for boreholes. Vertical accuracy will be $\pm$ 0.1 foot for boreholes.

14. All sampling activities will be documented in a field logbook and on forms. Documentation will include the following items listed in EMD OP FO.13: sampling activity name and number, sampling point name and number, sample number, name(s) of collector(s) and others present, date and time of sample

collection, sample container tag/label number (if appropriate), preservative(s), requested analyses, sample matrix, filtered or unfiltered, designation of quality control (QC) samples, collection methods, chain-of-custody control numbers, field observations and measurements during sampling, and signature.

Samples will be processed for shipment in accordance with EMD FO.13, the chain- of-custody form will be completed, and a chain-of-custody number assigned to it.

15. The data tracking process will be in accordance with EMD FO.14 using form FO.14A. The data entry process will be as prescribed on forms FO.14C, FO.14H, and FO.14K.

## 5.0 SAMPLE ANALYSIS

Groundwater, soil, water, wipe, and surface soil samples will be analyzed for a specific set of parameters based on historical use, and waste streams contained in the tanks. This section summarizes the analytical parameters for all sampling.

Sample analyses for the tank investigation include TCL volatiles, TCL semi-volatiles, TAL metals, radionuclides, and water-quality parameters (including nitrate/nitrite, sulfate, chloride, fluoride, pH, specific conductance, and TOC). Specific analytical parameters are shown in Table 5-1. Sample media and descriptions of the parameters for each sample were discussed in Section 3.2.

## TABLE 5-1
## ANALYTICAL PARAMETERS
## OU9 ORIGINAL PROCESS WASTE LINES

| ANALYSIS | TANKS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | T1 | T2,3 | T7 | T8 | T9,10 | T11,30 | T14,16 | T21,22 | T24,32 | T29 |
| CLP TAL for Metals | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CLP Vol TCL | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CLP SVol TCL | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| WQPL | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Total Organic Carbon | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Alpha Spectrum | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| HPGe Gamma | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Uranium 233,234 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Uranium 235 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Uranium 238 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Americium 241 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Plutonium 239, 240 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Tritium | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 0 | 0 | 0 |
| Cesium 137 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Notes:
CLP = Contract Laboratory Program
HPGE = High purity germanium
SVOL = Semi-Volatiles
TAL = Target Analyte List
TCL = Target Compound List
VOL = Volatiles
WQPL = Nitrate/Nitrite, Sulfate, Chloride, pH, Specific Conductance
1 = First set of analyses
2 = Second set of analyses

Radionuclide analyses for each sample will consist of preliminary analysis of alpha spectrum and HPGe gamma (designated as 1 on Table 5-1). If these analyses indicate the presence of radiological contamination, additional radionuclide analyses will include area-specific radiological parameters (designated as 2 on Table 5-1). The field crew will collect sample material sufficient enough to store a representative aliquot for additional analyses. Wipe samples will be analyzed for gross alpha, and gross beta.

Sample containers and preservatives are shown in Table 5-2. QC samples are shown in Table 5-3.

## 6.0 REFERENCES

U.S. Department of Energy, 1988. *Resource Conservation and Recovery Act Post-Closure Care Permit for U.S. D.O.E. Rocky Flats Plant Hazardous & Radioactive Mixed Wastes.* (CO7890010526). Volume XVI. October 5.

U.S. Department of Energy, 1991. *Federal Facility Agreement and Consent Order (Inter-Agency Agreement [IAG]: DOE, EPA, and CDH).* Washington, DC. January 22.

U.S. Department of Energy, 1992a. *Final Phase I RFI/RI Work Plan.* Rocky Flats Plant Original Process Waste Lines (Operable Unit 9). February.

U.S. Department of Energy, 1992b. *Final Historical Release Report for the Rocky Flats Plant.* Environmental Restoration Program. June.

**TABLE 5-2**
**SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES**
**FOR RESIDUE, SOIL, AND WATER SAMPLES**
**OU9 ORIGINAL PROCESS WASTE LINES**

| PARAMETER | CONTAINER | PRESERVATION | HOLDING TIME |
|---|---|---|---|
| **RESIDUE AND SOIL SAMPLES:** | | | |
| TAL Metals | 1 x 250 mℓ wide-mouth glass jar | Cool, 4°C | 180 days[1] |
| Cyanide | 1 x 250 mℓ wide-mouth glass jar | Cool, 4°C | 14 days |
| TCL Volatiles | 2 x 125 mℓ wide-mouth glass teflon-lined jar | Cool, 4°C | 7 days |
| TCL Semivolatiles | 1 x 250 mℓ wide-mouth teflon-lined jar | Cool, 4°C | 7 days until extraction, 40 days after extraction |
| Radionuclides | 1 x 1 ℓ wide-mouth glass jar | None | 180 days |
| **WATER SAMPLES:** | | | |
| TAL Metals | 1 x 1 ℓ polyethylene bottle | Nitric acid pH<2; Cool, 4°C | 180 days[1] |
| Cyanide | 1 x 1ℓ polyethylene bottle | Sodium hydroxide pH >12; Cool, 4°C | 14 days |
| TCL Volatiles | 2 x 40 mℓ VOA vials with teflon-lined septum lids | Cool, 4°C | 7 days |
| TCL Semivolatiles | 1 x 4 ℓ amber glass bottle | Cool, 4°C | 7 days until extraction, 40 days after extraction |
| Radionuclides | 4 ℓ polyethylene bottle(s) | Nitric acid pH <2; Cool, 4°C | 180 days |
| TOC | 1 x 250 mℓ polyethylene bottle | Sulfuric acid pH <2; Cool, 4°C | 28 days |
| Anions | 1 x 1 ℓ polyethylene bottle | Cool, 4°C | 28 days |
| Nitrate/Nitrite | 1 x 250 mℓ polyethylene bottle | Sulfuric acid pH <2; Cool, 4°C | 28 days |
| pH, temperature, and specific conductance | In situ, beaker or bucket | None | Analyze immediately |

Notes:
Holding Time for mercury is 28 days
C = Celsius
mℓ = milliliter
TAL = Target Analyte List
TCL = Target Compound List
ℓ = liters
TOC = Total Organic Carbon
VOA = Volatile Organic Analysis

# TABLE 5-3
# FIELD QC SAMPLE FREQUENCY
# OU9 ORIGINAL PROCESS WASTE LINES

| SAMPLE TYPE | TYPE OF ANALYSIS | SAMPLE FREQUENCY | |
|---|---|---|---|
| | | SOLIDS | LIQUIDS |
| Duplicates | Organics | 1/10 | 1/10 |
| | Inorganics | 1/10 | 1/10 |
| | Radionuclides | 1/10 | 1/10 |
| Field Blanks | Organics | N/R | N/R |
| | Inorganics | 1/20 | 1/20 |
| | Radionuclides | 1/20 | 1/20 |
| Equipment Blanks | Organics | 1/20 | 1/20 |
| | Inorganics | 1/20 | 1/20 |
| | Radionuclides | 1/20 | 1/20 |
| Trip Blanks | Organics | 1/20 | 1/20 |
| | Inorganics | N/A | N/A |
| | Radionuclides | N/A | N/A |

Notes:
N/A = Not Applicable
N/R = Not Required
1/10 = one quality control (QC) sample per ten samples collected

# APPENDIX A

# INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-1
MEDICAL BUILDING PROCESS WASTE

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| No Required Action | 1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements.<br><br>2. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. Investigation of removed tanks will consist of a single borehole drilled as closely as possible to the center of the original tank location. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of the original tank; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact). | 1. Conduct a HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey will be conducted using 10-foot grids and will cover the entire area of T-1 to delineate source.<br><br>2. Conduct a prework radiation survey of the borehole location to assess radioactive contamination. Survey will be conducted using the NaI instrument.<br><br>3. One borehole will be drilled as near to the center of the original tank location as possible. The borehole will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of the original tank unless the tank is in bedrock (if the base of the tank extends into bedrock, this sample will not be collected); and c) directly above the water table or bedrock/alluvium contact, whichever is encountered first. |

Notes:
HPGe = high purity germanium
NaI = sodium iodide
OP = EMD Operating Procedure
OU = Operable Unit

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-2, T-3 (IHSS 122) (Transferred from OU 13)
UNDERGROUND CONCRETE TANKS AND ABOVE-GRADE STEEL TANKS

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| 1. Locate and describe all underground tanks associated with site 122, including the specific waste streams handled by these tanks.<br><br>2. Conduct a radiation survey using a G-M shielded pancake detector and sideshielded FIDLER of site 122. The survey will be conducted using 10-foot grids and will cover the entire area of site 122. If "hotspots" are detected, the grid must be tightened to locate the source of the radiation. If the affected soils are covered with surfacing, 2-inch surface scrapes will be collected before constructing the boreholes required for this site.<br><br>3. Conduct a soil sampling survey after locating the underground tanks. Four boreholes will be placed around each tank associated with site 122 and will be drilled to a depth of 10 feet below the bottom of each tank or 3 feet into weathered bedrock, whichever is deeper. The soil samples will be composited to define each 2-foot interval and will be analyzed for HSL volatiles and nitrates. The soil samples will also be composited to represent 6-foot intervals. The 2-inch surface scrapes and 6 foot composites will be analyzed for total uranium, total plutonium, gross alpha, and gross beta. | 1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements.<br><br>2. Conduct residue sampling of each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. One sample will be collected from each tank. In instances where no residue is present, one wipe sample will be taken from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements.<br><br>3. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One borehole will be drilled on each accessible side of the tank. In all cases, boreholes will be drilled as close as possible to the tank structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling), collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock, for above-grade or on-grade tanks, mid-depth between the ground surface and the water table or alluvium/bedrock interface, whichever is encountered first; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends the bedrock/alluvium contact). | 1. Conduct a visual tank inspection.<br><br>2. Conduct a HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, NaI radiation survey will be conducted. The survey shall be conducted using 10-foot grids and will cover the entire area of T-2 and T-3 to delineate source.<br><br>3. Conduct a prework radiation survey of all sample locations to assess radioactive contamination. Survey will be conducted using the NaI instrument.<br><br>4. One residue sample will be collected from the above grade tank. In instances where no residue is present, one wipe sample will be collected from the interior surface of the tank. One water sample will be collected from the concrete vault. In instances where no water is present, one wipe sample will be collected from the interior surface of the vault. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements.<br><br>5. Five grab surface soil samples will be collected from discrete locations under above-grade tank and piping connections where leaks may have occurred. Six composite surface soil samples will be collected around the tanks. Soil samples will be collected according to OP GT.08, Surface Soil Sampling. Four boreholes will be drilled, one on each accessible side of the tanks. The boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. |

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-2, T-3 (IHSS 122)
UNDERGROUND CONCRETE TANKS AND ABOVE-GRADE STEEL TANKS

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| | | In all cases, boreholes will be drilled as close as possible to the tank structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock, for above-grade or on-grade tanks, mid-depth between the ground surface and the water table or alluvium/bedrock interface, whichever is encountered first unless the tank is in bedrock (if the base of the tank extends into bedrock, this sample will not be collected); and c) directly above the water table or bedrock/alluvium contact, whichever is encountered first.<br><br>6. If groundwater is encountered during borehole drilling, a BAT® sampler will be used to collect a groundwater sample, according to OP ST.22, In-Situ Sampling with BAT® Sampling. |

Notes:
HPGe = high purity germanium
HSL = hazardous substance list
NaI = sodium iodide
OP = EMD Operating Procedure
OPWL = Original Process Waste Lines
OU = Operable Unit
SOP = Standard Operating Procedure

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-7 (IHSS 159) (Transferred from OU 8)
RADIOACTIVE SITE - BLDG. 559

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| 1. Submit the report(s) documenting the radiometric survey conducted from 1975 to 1983 and any cleanup activities for this site.<br><br>2. Conduct a radiation survey using a G-M shielded pancake detector and sideshielded FIDLER of the areas affected by site 159. The survey will be conducted using 10-foot grids and will cover all the areas affected by site 159. If "hotspots" are detected, the grid must be tightened to locate the source of radiation.<br><br>3. Conduct a soil sampling survey of the soils affected by site 159 using cores drilled to a depth of 5 feet below the invert of the waste line(s) or 3 feet into weathered bedrock, whichever is deeper. Borehole core samples will also be composited to represent 6-foot intervals of soil. The 2-inch surface scrapes and the 6-foot composites will be analyzed for total plutonium, total americium, beryllium, total chromium, tritium, total nitrate, uranium 233/234, uranium 235, uranium 238, gross alpha, gross beta, and HSL metals. Two-inch surface scrapes will be sampled before constructing all boreholes and where surfacing exists to prevent the radiation survey. | 1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements.<br><br>2. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One boreholes will be drilled on each accessible side of the tank. In all cases, boreholes will be drilled as close as possible to the tank structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact). | 1. Conduct a HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey will be conducted using 10-foot grids and will cover the entire area of T-7 to delineate source.<br><br>2. Conduct a prework radiation survey of the borehole location to assess radioactive contamination. Survey will be conducted using the NaI instrument.<br><br>3. Four boreholes will be drilled; one on each accessible side of the tank vault. The borehole will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. In all cases, the boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling), collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock (if the base of the tank extends into bedrock, this sample will not be collected); and c) directly above the water table or bedrock/alluvium contact, whichever is encountered first. |

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-7 (IHSS 159)
RADIOACTIVE SITE - BLDG. 559

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| | | 5. If groundwater is encountered during borehole drilling, a BAT® sample will be used to collect a groundwater sample according to OP ST.22, In-Situ Sampling with BAT® Sampling. |

Notes:
HPGe = high purity germanium
HSL = hazardous substance list
NaI = sodium iodide
OP = EMD Operating Procedure
OU = Operable Unit

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-8 (IHSSs 126.1, 126.2) (transferred from OU 8)
OUT-OF-SERVICE UNDERGROUND PROCESS WASTE TANKS

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| 1. Determine and document the types of wastes stored in these tanks during use.<br><br>2. Conduct a soil sampling survey of the areas affected by sites 126.1 and 126.2. One soil borehole will be placed, downgradient of each tank associated with site 126 and will be drilled to a depth of 10 feet below the bottom of each tank. The soil samples will be composited to define each 2-foot interval and will be analyzed for HSL volatiles. In addition, the soils will be composited to represent 6-foot intervals and will be analyzed for nitrates, total americium, beryllium, total uranium, total plutonium, gross alpha, and gross beta. In addition to the soil boreholes, surface scrapes 2 inches deep will be taken at the same location as the soil borehole composites. The most downgradient borehole will be completed as a downgradient alluvial monitoring well. The location of this well will be proposed in the RFI/RI Workplan to be submitted in accordance with section I.B.9. of the Statement of Work. This well will be sampled immediately upon completion and quarterly thereafter. Groundwater samples will be analyzed for total nitrate, HSL violates, gross alpha, gross beta, total plutonium, total uranium, tritium, and HSL metals. Initial results of groundwater sampling and analysis will be submitted with the PSC report for this group of sites. | 1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements.<br><br>2. Conduct residue sampling of each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. One sample will be collected for each tank. In instances where no residue is present, one wipe sample will be taken from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements.<br><br>3. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One borehole will be drilled on each accessible side of the tank vault. In all cases, boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact). | 1. Conduct a HPGe survey of the area to assess the radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey will be conducted using 10-foot grids and will cover the entire area of T-8 to delineate source.<br><br>2. Conduct a prework radiation survey of all sample locations to assess radioactive contamination. Survey will be conducted using the NaI instrument.<br><br>3. Four boreholes will be drilled; one on each accessible side of the tank vault. The borehole will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. In all cases, boreholes will be drilled as near to the tank vault structure as possible. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock (if the base of the tank extends into the bedrock, this sample will not be collected); and c) directly above the water table or bedrock/alluvium contact, whichever is encountered first.<br><br>4. If groundwater is encountered during borehole drilling, a BAT® sampler will be used to collect a groundwater sample, according to OP ST.22, In-Situ Sampling with BAT® Sampling. |

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-8 (IHSSs 126.1, 126.2)
OUT-OF-SERVICE UNDERGROUND PROCESS WASTE TANKS

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE 1 |
|---|---|---|
| Notes:<br>HPGe = high purity germanium<br>HSL = hazardous substance list<br>NaI = sodium iodide<br>OP = EMD Operating Procedure<br>OPWL = Original Process Waste Lines<br>PSC =<br>RCRA = Resource Conservation and Recovery Act<br>RFI/RI = RCRA Facility Investigation/Remedial Investigation | | |



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APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-9, T-10 (IHSS 132) (Transferred from OU8)
RADIOACTIVE SITE #4 - 700
UNDERGROUND PROCESS WASTE TANKS

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| 1. Conduct a soil sampling survey of the areas affected by site 132. Soil boreholes will be placed around each tank associated with site 132 and will be drilled to a depth of 10 feet below the bottom of each tank or 3 feet into weathered bedrock, whichever is greater. The soil samples will be composited to define each 6-foot interval and will be analyzed for total americium, total beryllium, total uranium, total plutonium, total alpha, and total beta. | 1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements.<br><br>2. Conduct residue sampling of each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. One sample will be collected from each tank. In instances where no residue is present, one wipe sample will be taken from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements.<br><br>3. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One boreholes will be drilled on each accessible side of the tank vault. In all cases, boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock;<br>c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact). | 1. Conduct a visual tank inspection.<br><br>2. Conduct a HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI survey will be conducted. The survey will be conducted using 10-foot grids and will cover the entire area of T-9 and T-10 to delineate source.<br><br>3. Conduct a prework radiation survey of all sample locations to assess radioactive contamination. Survey will be conducted using the NaI instrument.<br><br>4. One residue sample will be collected from each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. In instances where no residue is present, one wipe sample will be collected from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements.<br><br>5. Four boreholes will be drilled; one on each accessible side of the tank vault. The boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. In all cases, boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling), collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock (if the base of the tank extends into bedrock, this sample will not be collected); and c) directly above the water table or bedrock/alluvium contact, whichever is encountered first. |

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-9, T-10 (IHSS 132)
RADIOACTIVE SITE #4 - 700
UNDERGROUND PROCESS WASTE TANKS

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| | | 6. If groundwater is encountered during borehole drilling, a BAT® sampler will be used to collect a groundwater sample according to OP ST.22, In-Situ Sampling with BAT® Sampling. |

Notes:
HPGe = high purity germanium
OP = EMD Operating Procedure
OPWL = Original Process Waste Lines
OU = Operable Unit

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-11, T-30
BUILDING 707 PROCESS WASTE PIT

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| No Action Required | 1. Conduct a prework radiation survey of boreholes locations according to OP FO.16, Field Radiological Measurements.<br><br>2. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One boreholes will be drilled on each accessible side of the tank vault location. In all cases, boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact). | 1. Conduct a HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey shall be conducted using 10-foot grids and will cover the entire area of T-11 and T-30 to delineate source.<br><br>2. Conduct a prework radiation survey of borehole location to assess radioactive contamination. Survey will be conducted using the NaI instrument.<br><br>3. Four boreholes will be drilled one on each accessible side of the tank vault. The boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. In all cases, boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock (if the base of the tank extends into bedrock, this sample will not be collected); and c) directly above the water table or bedrock/alluvium contact, whichever is encountered first.<br><br>4. If groundwater is encountered during borehole drilling, a BAT® sampler will be used to collect a groundwater sample according to OP ST.22, In-Situ Sampling with BAT® Sampling. |

Notes:
HPGe = high purity germanium
NaI = sodium iodide
OP = EMD Operating Procedure
OU = Operable Unit

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-14 (IHSSs 124.1, 124.2, 124.3) (OU10)
RADIOACTIVE LIQUID WASTE STORAGE TANKS

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| No required Action | 1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements.<br><br>2. Conduct residue sampling of each tank that has not been cleaned and painted since, removal from process waste service, to help characterize OPWL wastes. One sample will be collected. In instances where no residue is present, one wipe sample will be taken from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements.<br><br>3. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One borehole will be drilled on each accessible side of the tank vault location. In all cases, boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock, for above-grade or on-grade tanks, mid-depth between the ground surface and the water table or alluvium/bedrock interface, whichever is encountered first; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact). | 1. Conduct a HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey shall be conducted using 10-foot grids and will cover the entire area of T-14 to delineate source.<br><br>2. Conduct a prework radiation survey of all sample locations to assess radioactive contamination. Survey will be conducted using the NaI instrument.<br><br>3. One residue sample will be collected from each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. In instances where no residue is present, one wipe sample will be collected from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements.<br><br>4. Conduct a soil sampling survey of the areas affected by the tanks T-14. Three boreholes will be drilled on accessible sides of the tank vault. The borehole will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. In all cases, boreholes will be drilled as close as possible to the tank vault structure. Since contaminated soil has been detected in this area, five soil samples from each borehole will be collected from the following locations:<br><br>a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; and b) one composite sample at each 2-foot interval to a depth of 10 feet below the base of the tanks or until the water table or bedrock is encountered. The water table at this location is estimated to be at 5 to 8 feet below ground surface. Therefore, it is estimated that samples will be collected from depths of 2, 4, 6 and 8 feet in each borehole. |

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-14 (IHSSs 124.1, 124.2, 124.3) (OU10)
RADIOACTIVE LIQUID WASTE STORAGE TANKS

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| | | 5. If groundwater is encountered during borehole drilling, a BAT® sampler will be used to collect a groundwater sample according to OP ST.22, In-Situ Sampling with BAT® Sampling. |

Notes:
HPGe = high purity germanium
NaI = sodium iodide
OP = EMD Operating Procedure
OPWL = Original Process Waste Lines

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-16 (IHSS 125) (OU8)
HOLDING TANK, RFP TANKS 66, 67

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| 1. Submit the report(s) documenting the radiometric survey conducted from 1975 to 1983.<br><br>2. Conduct a radiation survey using a G-M shielded pancake detector and sideshielded FIDLER of site 125. If the releases occurred after surfacing was in place, then the survey should be conducted without removing the surfacing. If the spills occurred before the surfacing was placed then the top 2 inches of the soil surface will be sampled and analyzed for radiation before drilling and boreholes. The survey shall be conducted using the 10-foot grids and will cover all areas affected by site 125. If "hotspots" are detected, the grid must be tightened to locate the source of the radiation.<br><br>3. Conduct a soil sampling survey of the areas affected by sites 125. Soil boreholes will be placed around each tank associated with site 125 and will be drilled to a depth of 10 feet below the bottom of each tank. The soil samples shall be composited to define each 2-foot interval and will be analyzed for HSL volatiles. In addition, the soils will be composited to represent 6-foot intervals and will be analyzed for nitrates, total americium, beryllium, total uranium, total plutonium, gross alpha, and gross beta. In addition to the soil bores, - - - (p21; Table 5; IAG) | 1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements.<br><br>2. Conduct residue sampling of each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. One sample will be collected. In instances where no residue is present, one wipe sample will be taken from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements.<br><br>3. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One borehole will be drilled on each accessible side of the tank vault. In all cases, boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock, for above-grade or on-grade tanks, mid-depth between the ground surface and the water table or alluvium/bedrock interface, whichever is encountered first, c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact). | 1. Conduct a HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey shall be conducted using 10-foot grids and will cover the entire area of T-16 to delineate source.<br><br>2. Conduct a prework radiation survey of all sample locations to assess radioactive contamination. Survey will be conducted using the NaI instrument.<br><br>3. One residue sample will be collected from each tank which not been cleaned and painted since removal from process waste service, help characterize OPWL wastes. In instances where no residue is present, one wipe sample will be collected from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements.<br><br>4. Conduct a soil sampling survey of the areas affected by the tanks T-16. Two boreholes will be drilled on the downgradient side of the tank. The boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. In all cases, boreholes will be drilled as close as possible to the tank vault structure. Since contaminated soil has been detected in this area, five soil samples from each borehole will be collected from the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) one composite sample at each 2-foot interval to a depth of 10 feet below the base of the tanks or until the water table or bedrock is encountered. The water table at this location is estimated to be at 5 to 8 feet below ground surface. Therefore, it is estimated that samples will be collected from depths of 2, 4, 6 and 8 feet in each borehole. |

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-16 (IHSS 125) (OU8)
HOLDING TANK, RFP TANKS 66, 67

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| | | 5. If groundwater is encountered during borehole drilling, a BAT® sampler will be used to collect a groundwater sample according to OP ST.22, In-Situ Sampling with BAT® Sampling. |

Notes:
HPGe = high purity germanium
HSL = hazardous substance list
NaI = sodium iodide
OPWL = Original Process Waste Lines
OU = Operable Unit

should be IHSS 124 ?

## APPENDIX A
## INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
## TANK T-16 (IHSS 125) (OU8)
## HOLDING TANK, RFP TANKS 66, 67

(OU10) ?

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| No Required Action | 1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements.<br><br>2. Conduct residue sampling of each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. One sample will be collected. In instances where no residue is present, one wipe sample will be taken from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements.<br><br>3. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One borehole will be drilled on each accessible side of the tank. In all cases, boreholes will be drilled as close as possible to the tank structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock for above-grade or on-grade tanks, mid-depth between the ground surface and the water table or alluvium/bedrock interface, whichever is encountered first; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first, and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact). | 1. Conduct a visual tank inspection.<br><br>2. Conduct a HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey will be conducted using 10-foot grids and will cover the entire area of T-21, T-22, and T-27 to delineate source.<br><br>3. Conduct a prework radiation survey of all sample locations to assess radioactive contamination. Survey will be conducted using the NaI FIDLER.<br><br>4. One residue sample will be collected from each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. In instances where no residue is present, one wipe sample will be collected from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements.<br><br>5. Four boreholes will be drilled; one on each side of the tanks. The borehole will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. In all cases, boreholes will be drilled as close as possible to the tank structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling), collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock (if the base of the task extends into the bedrock, this sample will not be collected); and c) Directly above the water table or bedrock/alluvium contact, whichever is encountered first. |



76986

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-21, T-22, T-27
BUILDING 886 UNDERGROUND PROCESS WASTE PIT AND PORTABLE LIQUID DUMPSTER

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| | | 6. If groundwater is encountered during borehole drilling, a BAT® sampler will be used to collect a groundwater sample according to OP ST.22, In-Situ Sampling BAT® Sampling. |

Notes:
HPGe = high purity germanium
NaI = sodium iodide
OP = EMD Operating Procedure
OPWL = Original Process Waste Lines
OU = Operable Unit

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-24, T-32
BUILDING 881 PROCESS WASTE PIT

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| No Required Action | 1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements.<br><br>2. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One borehole will be drilled on each accessible side of the tank vault. In all cases, boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock;<br>c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact). | 1. Conduct a HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey will be conducted using 10-foot grids and will cover the entire area of T-24 and T-32 to delineate source.<br><br>2. Conduct a prework radiation survey of borehole location to assess radioactive contamination. Survey will be conducted using the NaI instrument.<br><br>3. Two boreholes will be drilled on the downgradient side of the tanks. The boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. In all cases, boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless the base of tank is in bedrock, (if the base of the tank extends into bedrock, the sample will not be collected); and c) directly above the water table or bedrock/alluvium contact, whichever is encountered first.<br><br>4. If groundwater is encountered during borehole drilling, a BAT® sampler will be used to collect a groundwater sample according to OP ST.22, In-Situ Sampling with BAT® Sampling. |

Notes:
HPGe = high purity germanium
NaI = sodium iodide
OP = EMD Operating Procedure
OU = Operable Unit

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-15, T-17 (IHSS 146)
BUILDING 774 PROCESS WASTE TANKS (REMOVED)

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| 1. Submit the report(s) documenting the radiometric survey conducted from 1975 to 1983.<br><br>2. Verify the location of these tanks.<br><br>3. Conduct a radiation survey using a G-M shielded pancake detector and sideshielded FIDLER of the areas affected by site 146. The survey will be conducted using 10-foot grids and will cover all areas affected by site 146 including the road and ground surfaces affected by the overflow of these tanks. If concrete or asphalt surfacing exists over affected soils, the surface soils will be sampled before constructing the required boreholes. If "hotspots" are detected, the grid must be tightened to locate the source of the radiation.<br><br>4. Conduct a soil sampling survey of all areas affected by site 146 including the areas affected by tank overflow, using surface soil scrapings to a depth of 2 inches and soil cores composited to represent each 2 feet of soil. The boreholes will be drilled to a depth of 10 feet below the tank inverts or to below the bottom of the building, whichever is required to assess the contamination of the soils related to this site. The location of six boreholes will be proposed in the Work Plan after verifying the location of these tanks. For three of the six boreholes, the core samples will be composited to represent 2-foot intervals. These 2-foot composites will be analyzed for HSL volatiles and HSL semi-volatiles. For all six boreholes the soils will be composited to represent 6-foot intervals. The | 1. No boreholes are proposed for tanks that were located beneath production buildings. | 1. Conduct a HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey will be conducted using 5-foot grids and will cover the entire area of T-15 and T-17 to delineate source.<br><br>2. No soil sampling survey will be conducted. Locations of removed Tanks T-15 and T-17 are beneath the south wing of Building 774. |

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-15, T-17 (IHSS 146)
BUILDING 774 PROCESS WASTE TANKS (REMOVED)

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| borehole composites and surface scrapes will be analyzed for total plutonium, total americium, beryllium, total chromium, tritium, total nitrate, uranium 233/234, uranium 235, uranium 238, gross alpha, gross beta, total sodium, total sulfate, and HSL metals. | | |

Notes:

HPGe = high purity germanium
HSL = hazardous substance list
NaI = sodium iodide
OU = Operable Unit

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-15, T-17 (IHSS 146)
BUILDING 774 PROCESS WASTE TANKS (REMOVED)

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| No Required Action | 1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements.<br><br>2. Conduct residue sampling of each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. One sample will be collected. In instances where no residue is present, one wipe sample will be taken from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements.<br><br>3. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One borehole will be drilled on each accessible side of the tank. In all cases, boreholes will be drilled as close as possible to the tank structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) mid-depth between the ground surface and the water table or alluvium/bedrock interface, whichever is encountered first; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact). | 1. Conduct a visual tank inspection.<br><br>2. Conduct a HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey will be conducted using 10-foot grids and will cover the entire area of T-29 to delineate source.<br><br>3. Conduct a prework radiation survey of all sample locations to assess radioactive contamination. Survey will be conducted using the NaI instrument.<br><br>4. Two residue samples will be collected from the above grade tank. In instances where no residue is present, one wipe sample will be collected from the interior surface of the tank. One water sample will be collected from the concrete vault north of Tank T-29. In instances where no water is present, one wipe sample will be collected from the interior surface of the vault. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements.<br><br>5. Conduct a soil sampling survey of the area affected by Tank T-29. Two grab surface soil samples will be collected from discrete locations where leaks may have occurred. Soil samples will be collected according to OP GT.08, Surface Soil Sampling.<br><br>Four boreholes will be drilled; one on each accessible side of the tank. The boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. In all cases, boreholes will be drilled as close as possible to the tank structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) mid-depth between the ground |

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-15, T-17 (IHSS 146)
BUILDING 774 PROCESS WASTE TANKS (REMOVED)

| INTER-AGENCY AGREEMENT REQUIRED ACTION | OU9 WORK PLAN REQUIRED ACTION | OU9 PROPOSED ACTION FOR STAGE I |
|---|---|---|
| | | encountered first unless the tank is in bedrock (if the base of the tank extends into bedrock, this sample will not be collected); and c) directly above the water table or bedrock/alluvium contact, whichever is encountered first.<br><br>6. If groundwater is encountered during borehole drilling, a BAT® sampler will be used to collect a groundwater sample according to OP GT.22, In-Situ Sampling with BAT® Sampling. |

Notes:
HPGe = high purity germanium
NaI = sodium iodide
OP = EMD Operating Procedure
OPWL = Original Process Waste Lines
OU = Operable Unit
RFP = Rocky Flats Plant

# APPENDIX B

# ANALYTICAL DATA FOR TANK T-27

ANALYTICAL REPORT

ROCKWELL INTERNATIONAL
ROCKY FLATS PLANT
P.O. BOX 464
GOLDEN, COLORADO 80402

GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. W. Hawes, Env. Mgmt. 250
R. E. Rothe, Crit. Mass. 886
W. I. Yamada, Pu Rec. Proc. 130

File

LAB NUMBER: E89-1730

DATE: 10-9-89
ACCOUNT NO: 986122-A3

APPROVED: George K. Campbell
G. K. Campbell

SAMPLE DESCRIPTION

Sample Description: Soil Samples (886 tank leak) #1, #2, #3. Analysis Required: Uranium isotopics, nitrate (colorimetric) and pH

ANALYSIS RESULTS

Soil Samples Location

Refer to the attached diagram for the specific location where soil samples were taken.

Uranium Isotopics

An aliquot of each soil sample was weighed as received, weighed after drying in an oven at approximately 100 degrees centigrade to determine the percent moisture content and weighed again after drying in a muffle furnace at approximately 600 degrees centigrade to determine moisture and volatiles content. Each soil was then prepared for uranium isotopic analysis according to the laboratory's procedure and analyzed by alpha spectrometry. The following results are given as activity in pCi per gram of dried and muffled sample weight and are isotopically consistent with natural occurring uranium, where the U235 alpha activity is approximately 2 percent of the U238 and U234 sum.

pCi/gram dried

| | U238 | U235 | U234 |
|---|---|---|---|
| Soil #1 | 0.88 ± 0.10 | 0.04 ± 0.01 | 1.2 ± 0.1 |
| Soil #2 | 0.87 ± 0.10 | 0.03 ± 0.01 | 0.80 ± 0.10 |
| Soil #3 | 0.97 ± 0.11 | 0.04 ± 0.01 | 1.0 ± 0.1 |

pCi/gram muffled

| | U238 | U235 | U234 |
|---|---|---|---|
| Soil #1 | 0.89 ± 0.10 | 0.04 ± 0.01 | 1.2 ± 0.1 |
| Soil #2 | 0.88 ± 0.10 | 0.03 ± 0.01 | 0.81 ± 0.10 |
| Soil #3 | 0.98 ± 0.12 | 0.04 ± 0.01 | 1.0 ± 0.1 |

ANALYTICAL REPORT E89-1730 Date: 10-9-89

| | % moisture loss after drying at 100° C | % moisture + volatiles loss after muffling at 600° C |
|---|---|---|
| Soil #1 | 1.53 | 2.62 |
| Soil #2 | 1.50 | 2.42 |
| Soil #3 | 3.87 | 5.12 |

The quality assurance data associated with the isotopic analyses were acceptable and are on file in the General Laboratory.

The laboratory has a National Institute of Science and Technology (formerly National Bureau of Standards) Rocky Flats Soil Standard Reference Material (SRM) 4353 which was collected at Rocky Flats and certified for U238 and U234. However, it is not known where at the Rocky Flats Plant the samples for the reference material were taken, or if the SRM is representative. Certified values are as follows:

Activity Concentration (air-dried and pulverized RF soil)

| | Bq/g | Pci/g |
|---|---|---|
| U238 | 0.0389 | 1.05 |
| U234 | 0.0391 | 1.06 |

Using the assumption that for natural uranium, the U235 alpha activity is 2 percent of the U238 and U234 sum, the U235 activity for SRM 4353 Rocky Flats soil can be estimated as 0.04 pCi/g. Comparing these values with the three soil samples listed above, it appears that the soils are isotopically similar for uranium to the SRM 4353 RF soil. Again, it is not known if these activity levels are typical for the Rocky Flats area and surrounding areas. Background soil isotopic information is available on plantsite, possibly from S.A. Anderson of Waste Compliance, G.L. Potter in H.S.&E. or from the Environmental Restoration group on plantsite.

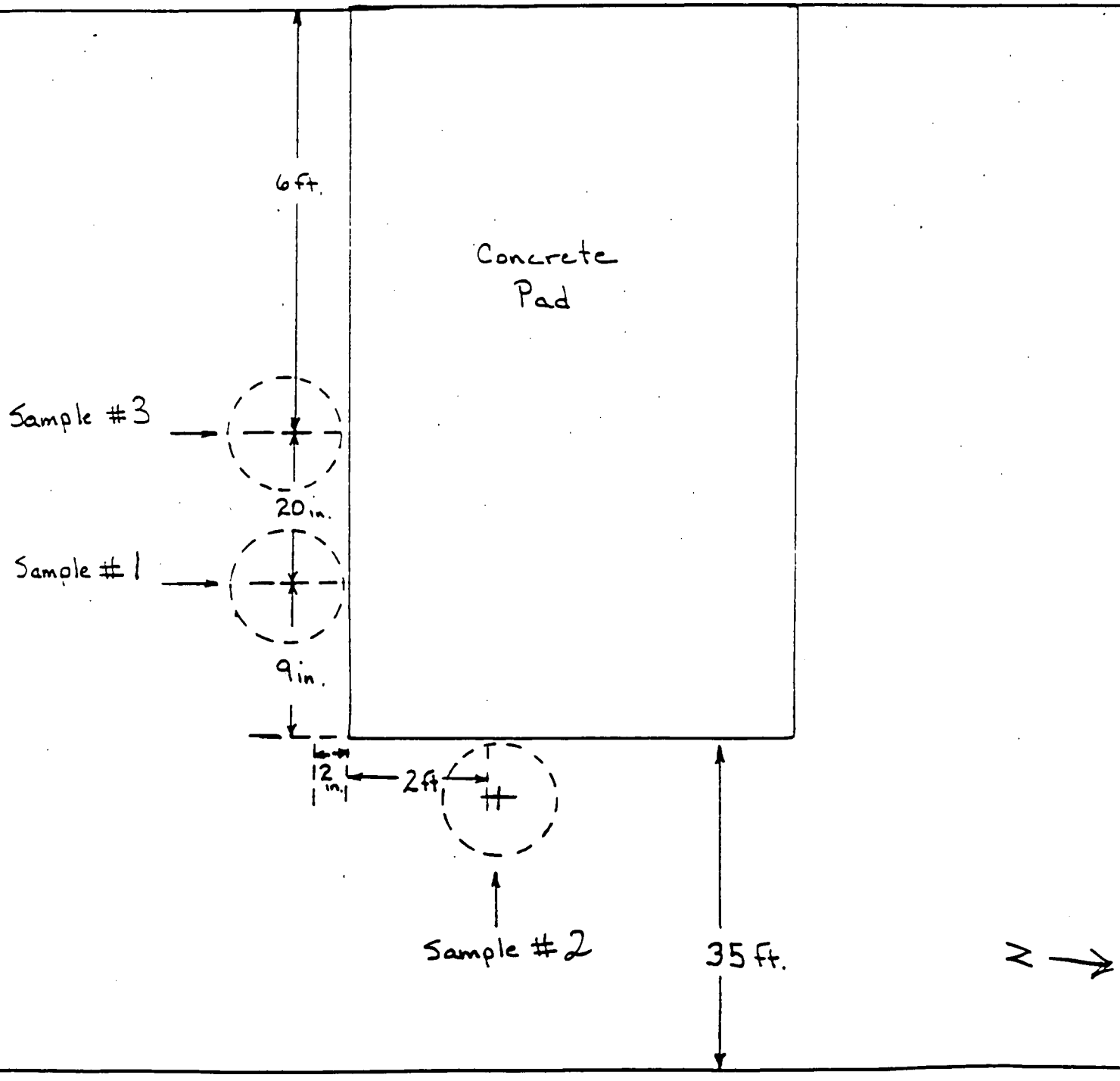
Nitrate (colorimetric) and pH

| | Nitrate (mg/kg) | pH |
|---|---|---|
| Soil #1 | 10 | 6.6 |
| Soil #2 | 8 | 6.9 |
| Soil #3 | 8 | 7.2 |

E89-1730
9-27-89

888
Guard
Post

Sidewalk




886 Bldg.